THE
ANATOMY
OF THE
HUMAN BODY
ABRIDG'D:

OR,

A ſhort and full View of all the PARTS of the BODY.

Together with

Their ſeveral Uſes drawn from their Compoſitions and Structures.

By JAMES KEILL, M. D.

> *Quibus autem expoſitis, ſatis docuiſſe videor, Hominis natura, quanto omnes anteiret animantes, ex quo debet intelligi, nec figuram, ſitumque membrorum, nec ingenii mentiſque vim talem effici potuiſſe fortuna.*
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TO

EDWARD TYSON,

Doctor of PHYSICK.

I Would ſcarce have adventured the Publiſhing of the following Sheets, if, after a particular and careful Peruſal, you had not been pleaſed to adviſe and encourage me to it; and I deſire the Favour of prefixing your Name to them, that the World may know your Approbation, which will ſufficiently ſecure me from Cenſure, and recommend them, as containing ſomething exact and uſeful: For your Skill and Judgment in this Subject is well known, and abundantly demonſtrated by thoſe Treatiſes with which you have obliged the World; and the Publick Lectures, by which you have adorned the honourable and uſeful Office you have held for ſeveral Years.

BUT yet I am not ſo vain as to think there are no Slips nor Errors in this little Treatiſe, nor will I impoſe ſo far upon your Goodneſs and Civility, as to expect your Patronage of them; I only hope, that, after your Example, others will be ſo candid and civil, as to paſs them over.

I do alſo readily accept of this Occaſion, to pay my moſt hearty Acknowledgments for your private Favours and Civilities. And as I have a true Eſteem for your Merits, ſo I ſhall be always ready to ſhew myſelf

Your moſt Humble

and Obliged Servant,

JAMES KEILL.

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THE ANATOMY OF THE HUMAN BODY ABRIDG'D.

CHAP. I.

Of the Component, External, and Common Parts of the Body.

SECT. I.

Of the Component Parts.

I Purpoſely paſs over the various Definitions of a Part, as being of no great Uſe; and for the ſame Reaſon I will not trouble the Reader with the ſeveral Diviſions which Anatomiſts make of the Parts of the Human Body: It is ſufficient to know, that all the Parts are made up of Threads, or Fibres, of which there be different Kinds; for there are ſome ſoft, flexible, and a little elaſtick;

All the Parts are made up of Fibres.

and theſe are either hollow like ſmall Pipes, or ſpongeous, and full of little Cells, as the nervous and fleſhy Fibres; others there are more ſolid and flexible, but with a ſtrong Elaſticity or Spring, as the membranous and cartilaginous Fibres; and a third Sort are hard and inflexible, as the Fibres of the Bones. Now, of all theſe, ſome are very ſenſible, and others are deſtitute of all Senſe; ſome ſo very ſmall as not to be eaſily perceived; and others, on the contrary, ſo big as to be plainly ſeen. And moſt of them, when examined with a Microſcope, appear to be compoſed of ſtill ſmaller Fibres.

Now theſe Fibres do firſt conſtitute the Subſtance of the Bones, Cartilages, Ligaments, Membranes, Nerves, Veins, Arteries and Muſcles. And again, by the various Texture, and different Combination of ſome or all theſe Parts, the more compound Organs are framed; ſuch as the Lungs, Stomach, Liver, Legs and Arms, the Sum of all which make up the Body.

SECT. II.

Of the External Parts.

The Diviſion of the Body.

THE Body is divided into four principal Parts, which are, the Head, the Thorax, the Abdomen, and the Extremities, *viz.* the Arms and Legs.

The External Parts of the Head.

The External Parts of the Head, or upper Cavity, are, the Face, and the Clava, or hairy Scalp. The Parts of the Face are, the

Brow, the Ears, the Eyes, the Cheeks, the Noſe, the *Philtrum* and its Sides, the Muſtaches, the Lips, the Mouth, and the Chin. The Parts of the hairy Scalp, are, the *Sinciput*, or Forehead, under which lieth the *Os Frontis*: It reaches to the Βρεγμα, or Meeting of the Coronal with the ſagittal Suture. The *Vertex*, or Crown of the Head, is where the Hairs turn as it were round a Point; and from thence to the firſt Joint of the Neck, is the *Occiput*, or Hind-head. The Temples are the Sides of the hairy Scalp, under which are the crotaphite Muſcles, the *Oſſa Petroſa*; they reach to the *Suturæ Squamoſæ*.

Of the Ear.

The External Ear is divided into two Parts, of which the upper is called *Pinna*, or the Wing; the lower, *Fibra*, or Lobe. The Parts of the *Pinna* are, the *Helix*, which is the outward Circle or Border of the Ear; the *Anti-helix*, which is the Semi-circle within the other: The lower End of the Semi-circle makes a little Prominence, which is called *Antitragus*; becauſe there is another Prominence juſt oppoſite to it, which is called *Tragus*, by reaſon of ſome Hair that is upon it. The Cavity made by the Extremities of the *Helix* and *Anti-helix* is called *Concha*: The Hollow in the Middle of the Ear is called *Alvearium*; it has a Hole which leads to the *Tympanum*, named the *Meatus Auditorius*.

Of the Eyes.

The External Parts of the Eyes are, the *Supercilia*, or Eye-brows, the *Canthus Internus*, or the great Angle, where the *Caruncu-lus Lachrymalis* is; the *Canthus Externus*, or the little Angle, which is the fartheſt from the Noſe; the *Palpebræ*, or the upper and lower

Eye-lids: The *Cilia*, which are little Cartilages on the Edge of the Eye-lids: The Hairs planted upon the Cilia, in form of a Paliſado; the *Puncta Lachrymalia*, which are two little Holes near the big Angle of the Eye. The Orbit is a Cavity made by the Bones, in which the Globe of the Eye is contained, with its ſix Muſcles; the *Tunica Conjunctiva*, which is the White of the Eye; the *Cornea*, which is the tranſparent Part of the Eye; the *Iris*, or Rain-bow, in the Middle of which is the *Pupilla*, or Sight.

Of the Noſe, Lips, &c. The Noſe has its *Spina* or Ridge, which is long. The *Acroriſion*, which is cartilaginous, and reaches from the End of the Spine to the *Globulus*, or Tip of the Noſe. The Noſtrils are the Paſſages into the Noſe. The *Alæ*, or Wings of the Noſe, are the Sides of the Noſtrils. The *Columna* is the little fleſhy Portion which reaches from the Tip of the Noſe to the *Philtrum*; it divides the Noſtrils. The *Philtrum* is the Hollow which divides the upper Lip immediately under the Noſe. The Cheeks reach from the lower Eye-lids to the Lips. The *Mentum*, or Chin, is the Fore-part of the lower Jaw. The lower Jaw reaches from the two Ears to the Chin, incluſively. The Lips are the muſculous Fleſh at the Entry of the Mouth; their external Part is called *Prolabium*, and that which is tinctured red, *Proſtomion*. The Gums are the Fleſh which covers the lower Part of the Teeth.

Of the Neck. The Neck reaches from the Head to the *Clavicula*, or Channel-Bones. Its Parts are the *Jugulum* or Throat, which is its Fore-part, along which deſcends the *Trachea Arteria*, or Wind-pipe, and the *Oeſophagus*, or Gullet. The Eminence which appears in the upper Part of the Throat is called *Pomum Adami*. The *Cervix*, which is the hind Part of the Neck; its upper Part is called *Lophia*, the middle *Foſſa*, and the lower *Epomis*. The *Parotides* make the upper and lateral Part of the Neck, *Terthra* the middle, and *Paralophia* the lower.

Of the External Parts of the Thorax, or Middle Cavity.

All that lies betwixt the Baſis of the Neck, and the *Diaphragma*, or Midriff, that is, down to the laſt Ribs, is called the *Thorax* or Cheſt. The Fore-part of the *Thorax* is called the Breaſt; in it are the *Claviculæ*, or Channel-Bones; and the *Sternum*, or Breaſt-bone, which is in the Middle; it begins at the *Claviculæ*, and terminates in the *Cartilago-Xiphoides*, or Sword-like Cartilage. Under the *Sternum* lies the *Mediaſtinum*, and the Heart in its *Pericardium*. The *Mammæ*, or Breaſts, are two round Tumours, which appear upon the Fore-part of the Cheſt, under which are ſituated Part of the Ribs, the *Pleura*, and the Lungs: There ſtands upon their Centre a little Protuberance, called *Papilla*, or Nipple which is encompaſſed with a reddiſh Circle, called *Areola*. The Hollow in the Middle of the Breaſt, below the Breaſts, is called *Scrobiculus Cordis*. The hinder Part of the *Thorax* is called the Back, compoſed of twelve *Vertebræ*, or Joints, and two *Scapulæ*, or Shoulder-Blades, which are the two upper Parts of the Back on the Sides of the *Vertebræ*. The lateral Parts of the *Thorax* are called *Periſterna*.

Of the External Parts of the Abdomen, *or lower Belly.*

The lower Belly extendeth from the *Cartilago-Xiphoides* to the *Os Pubis;* the fore Part is called *Abdomen,* and the hinder Part the Back-ſide. The *Abdomen* is divided into upper, middle, and lower Parts.

The upper reaches from the *Cartilago-Xiphoides,* till within two Fingers Breadth above the Navel; it is called *Epigaſtrium;* and its two Sides *Hypochondria:* The Right covers the greateſt Part of the Liver; the Left, the Spleen, Part of the Stomach, and *Colon.* The middle Part of the *Abdomen* is only two Fingers Breadth above, and as much below the Navel; it is called *Regio Umbilicalis;* its Middle is called *Umbilicus,* or Navel. Under the Middle of this Region lies all the *Inteſtinum Jejunum,* and Part of the *Ilium.* The Sides of this Region are called by *Gliſſon, Epicolicæ,* becauſe they cover the *Colon.* Under the right is contained the right Kidney, with Part of the *Colon* and *Jejunum:* Under the left is contained the left Kidney, with Part of the *Colon* and *Jejunum.* The lower Part of the *Abdomen* reaches from the umbilical Region to the lower Part of the *Os Pubis;* it is called the *Hypogaſtrium;* it covers the Bladder, Womb, and the *Rectum* or Straight-gut. The lower Part of the *Hypogaſtrium* is called *Pecten,* or *Regio Pubis;* its Sides *Inguina,* or Groins. The Sides of the *Hypogaſtrium* are called *Ilia,* either becauſe they contain almoſt all the Gut *Ilium,* or becauſe they terminate at the lower Part of the *Os Ilium.* The *Inguina,* or Groins, are below the *Ilia,* where there is a Part of the Muſcle *Cremaſter,* with the Productions of the *Peritonæum.* The hind Part of the *Abdomen* is called the Backſide;

ſide; it reaches from the laſt Ribs to the Extremity of the *Os ſacrum*. It is divided into two Parts. The upper is called the Small of the Back, its Sides, the Loins; the Middle of the lower Part is called *Radius*; as its lower End is the *Anus*, and its Sides the *Nates*, or Buttocks. The *Perinæum* is the Space between the *Anus* and the *Scrotum* in Men, and the *Vulva* in Women.

Of the External Parts of Generation in Men.

The External Parts of Generation proper to Men are, the Yard and the *Scrotum*. The Extremity of the Yard is called the *Glans*: The *Preputium* or Fore-ſkin is the Skin doubled, which covers the *Glans* like a Hood. The *Frænum*, or Bridle, is a little whitiſh-coloured Ligament, which ties the Fore-ſkin and the *Glans* together beneath. The Edge of the *Glans*, where the *Præputium* begins, is called *Corona*, or Crown. The *Urethra* is the Canal which runs along the under Side of the Yard, thro' which the Seed and the Urine paſs. The *Rapha*, or Ridge, is a Line, which running along the under Side of the Yard, divides the *Scrotum* and *Perinæum* in two; its Length is from the *Frænum* to the *Anus*. It is not ordinarily cut in the Operation for the Stone; firſt, becauſe it is harder than any other Part of the Skin there, and then cutting upon the Interſtices of the Muſcles, the Sides of the Wound do not ſo eaſily unite. The *Scrotum* is the Purſe which contains the two Teſticles.

Of the External Parts of Generation in Women.

The External Parts of Generation proper to Women are, the *Vulva*, or great Chink, ſituated below the *Os Pubis*, and covered with Hair; above this there is a little Swelling made by ſome Fat under the Skin, which is called *Mons Veneris*. The *Labia*, or Lips of the great Chink, are only the Skin ſwell'd by ſome Fat underneath; theſe being a little ſeparated, there appear the *Nymphæ*, one on each Side of the Chink; they are two ſmall Pieces of Fleſh reſembling the Membranes that hang under the Throats of Pullets. In the Angle of the great Chink, next the *Os Pubis*, is the Extremity of the *Clitoris*, covered with a little Hood of the Skin called *Præputium*. A little deeper on the ſame Side of the *Vulva*, there is a little Hole, which is the Orifice of the Neck of the Bladder. On the oppoſite Side, next the *Anus*, are *Glandulæ Myrtiformes*, ſituated in the *Foſſa Magna*, or *Navicularis*; and in this Angle of the Chink there is a Ligament called the Fork, which is torn in the firſt Birth.

Of the External Parts of the Arms, Fore-arms, and Hands.

The Arm is from the Joint of the Shoulder to the Elbow, which is the Place where we bend our Arm. The Fore-arm is from the Elbow to the Wriſt or *Carpus*. The Hand is all that which is betwixt the Wriſt and the Ends of the Fingers. The Parts of the Hand are, the *Metacarpus*, which is from the Wriſt to the Root of the Fingers; the Out-ſide, which is the Back of the Hand; and the Inſide, which is the Palm of the Hand; the *Mons Pollicis* is the fleſhy Part of the Hand nigh the Thumb; the Finger next the Thumb is called the *Index*, or Fore-finger; then follows the Middle, the Ring-finger, and the Little one. Upon the Extremities of the Fingers are the Nails; the white Spot, which is at the Root of the Nails, is called *Onyx*.

Of the External Parts of the Thigh and Leg.

The Thigh is from the Haunch to that Joint of which the Fore-part is called the Knee; the Back-part, the Ham.

The Leg is from the Knee to the *Tarſus*; its Fore-part is called the Shin, and the Back-part, the Calf of the Leg: The Eminences, which are at the Extremity nigh the *Tarſus*, are called the outer and inner Ankles of the Foot: The *Tarſus* is from the Ankles to the *Metatarſus*, or Breadth of the Foot, which goes to the Root of the Toes: The upper Part of the Foot is called Inſtep; the under Part, the Sole of the Foot: The Toes are five in Number, with their Nails.

SECT. III.

Of the common Parts of the Teguments.

Of the Epidermis *or* Cuticula.

THE firſt and outermoſt Covering of the Body is the *Cuticula*, or Scarf-ſkin, by the *Greeks* called Επιδέρμις. This is that ſoft Skin which riſes in a Bliſter upon any Burning, or the Application of a bliſtering Plaiſter. It ſticks cloſe to the Surface of the true Skin, to which it is alſo tied by the Veſſels which nouriſh it, tho' they are ſo ſmall as not to be ſeen. When we examine the Scarf-ſkin with a Microſcope, it appears to be made up of ſeveral Lays, of exceeding ſmall Scales, which cover one another, more or leſs according to the different Thickneſs of the Scarf-ſkin, in the ſeveral Parts of the Body.

In the Lips, where the Scales appear plaineſt, becauſe the Skin is thinneſt, they only, in a Manner, touch one another. Now theſe Scales are either the excretory Ducts of the Glands of the true Skin, as, I think, is apparent in Fiſhes; or elſe theſe Glands have their Pipes opening between the Scales. *Lewenhoeck* reckons, that in one cuticular Scale there may be five hundred excretory Channels, and that a Grain of Sand will cover two hundred and fifty Scales: So that one Grain of Sand will cover one hundred twenty-five thouſand Orifices, through which we daily perſpire.

The Scales are often glewed to one another by the groſſer Parts of our inſenſible Tranſpiration, hardning upon them by the heat of our Body, which carries off the more volatile Particles. The Humour which is afterwards ſeparated by the Glands of the Skin, being pent in between the Scales, cauſes frequent Itchings, and where the Matter has been long pent up, ſmall Pimples; for the removing of which, Nature directs to thoſe wholeſome Remedies of frequent Rubbing, and Waſhing or Bathing.

The Uſe of the Scarf-ſkin is to defend the Nerves of the Skin, which are the Origin of the Senſe of Feeling, from the Injuries of rough and hard Bodies, as well as the Air; for either thoſe would make too exquiſite and painful an Impreſſion upon the naked Nerves; or the Air would dry them, ſo as that they would be leſs ſuſceptible of the nicer Touches of Pleaſure.

SECT.

SECT. IV.

Of the Skin.

The Parts of the Skin.

WE remark in the Skin, the Scarf-ſkin being raiſed, three Parts. The firſt is an infinite Number of *Papillæ Pyramidales;* they are the Ends of all the Nerves of the Skin, each of which are encloſed in two or three Covers of a Pyramidal Figure, and theſe Covers are each above another. They may be eaſily ſeen and ſeparated in the Skin of an Elephant, and in the Skin of the Feet of ſeveral other Animals. Between theſe *Papillæ* are an infinite Number of Holes, which are the Orifices of the excretory Veſſels of the Miliary Glands underneath. About the *Papillæ* is ſpread a mucous Subſtance, which, becauſe it is pierced by them, and conſequently full of little Holes, is called by *Malpighius* the *Corpus Reticulare;* its Uſe is, to keep the Extremities of the Nerves ſoft and moiſt, and ſenſible of the ſlighteſt Touches. The ſecond Part is a Web of Nervous Fibres, and other Veſſels differently interwoven; and it is the *Parenchyma,* or that Part of the Skin that the Parchment is made of. The third Part is an infinite Number of Miliary Glands, about which there is much Fat, they ly under the other two Parts; they ſeparate the Matter of Sweat and inſenſible Tranſpiration. Each Gland receives a Nerve and Artery, and ſends out a Vein and Excretory-Veſſel, which laſt paſſes through the other two Parts to the *Cuticula,* for the diſcharging the Body of this Matter, and for the moiſtning the *Cuticula* and the *Papillæ Pyramidales*, that they may not dry, which would very much hurt the Senſe of Touching. Upon the Surface of the Skin there are many parallel Lines, which are cut by as many parallel ones. Theſe Interſections make Spaces of a Rhomboidal Figure; and out of each Angle, for the greateſt Part, grows a Hair ſhorter or longer, as Nature requires in the ſeveral Parts of the Body; but in the Palm of the Hand, where there are no Hairs, theſe Lines do not interſect one another, and on the Ends of the Fingers they are ſpiral.

The Thickneſs of the Skin.

The Skin is ſix Times thicker than the Scarf-ſkin; And in the Sole of the Foot it is much thicker than in the Face, Hands, and other Parts. In the Summer it is ſofter, becauſe the Pores are wider. In the Winter it is more compact and harder, becauſe the Pores are more cloſe; therefore the Hairs of Beaſts ſtick faſter, and Furs made of them are better in that Seaſon. In ſome the Skin is white, in others, black and tawny; which probably comes from the different Colours of the Mucoſity which covers the *Parenchyma* of the Skin; for the Fibres of the Skin in all are white, and there is little or no Difference in the Colour of different Bloods.

The Uſe of the Skin.

The Skin is not only a Covering in which all the Parts of the Body are wrapt up, but in it alſo Nature has placed the Organs of the Senſe of Feeling, ſo that not the leaſt thing hurtful can aſſault us without our Knowledge. And as it preſerves us from external Offences, ſo it relieves us of noxious and ſuperfluous internal Humours; its Glands being the Emunctories of the whole Body, through which not only the peccant Humours paſs, but likewiſe the greateſt Part of the Liquors which we drink; which having Part of their Office in conveying the Aliments into the Blood, are in the next Place, to diſſolve the ſaline and terreſtrial Particles, to be carried off through the Glands of the Skin and Kidneys.

Now the Sum of all theſe Particles ſtrained through the Cuticular Glands, is by *Sanctorius* reckoned to amount to about fifty Ounces a Day in *Italy*: So that ſuppoſe a Man's Body to weigh 160 Pounds, then in 51 Days we perſpire a Quantity equal to the Weight of the whole Body. And from the Conſideration of this and other Evacuations, our Bodies are ſaid to be renewed and changed in ſome ſtated Times; but that the Veſſels or ſolid Parts of the Body do conſtantly decay, waſte and evaporate, does not at all, to me, ſeem probable; nor, if they do, is it poſſible to determine in what Time there is a total Change: And I am more apt to think, that the Fluids only conſume; of which tho' ſeveral Pounds are daily loſt, yet it is not from thence certain when the old Stock is ſpent, and the Veſſels filled with new Juices; for, beſides that the true Quantity of Blood in the Body is not certainly known, we can never be ſure whether they be new or old Juices; or a Mixture of both, which are conſtantly flying off; and if a Mixture, which is moſt probable, in what Proportion they are mixed, which muſt neceſſarily be known, in order to determine when the old Maſs is entirely evacuated. But that ſome of our native Blood does remain in the Body, even to the laſt Stages of Life, ſeems credible from hence, that ſome have fallen into the Small-pox at 80 and 90 Years of Age.

SECT. V.

Of the Hair.

THE Hair may juſtly be reckoned one of the common Teguments of the Body, not only for its Uſe, but alſo becauſe it is to be found upon all the Parts of the Body, except the Soles of the Feet, and Palms of the Hands. It grows longeſt upon the Head, Beard, in the Arm-pits, and about the Privities. When we examine the Hairs with a Microſcope, we find that they have each a round bulbus Root, which lies pretty deep in the Skin, and which draws their Nouriſhment from the ſurrounding Humours; that each Hair conſiſts of five or ſix others wrapt up in a common Tegument or Tube. They grow as the Nails do, each Part near the Root thruſting forward that which is immediately above it, and not by any Liquor running along the Hair in Tubes, as Plants grow. Their different Colours depend much upon the different Temperaments and Quality of the Humours that nouriſh them. The Uſe of the Hairs is for a Covering and Ornament to the Body. Whatever the efficient Cauſe may be why a Man has a Beard, and a Woman none, it is certain, the final Cauſe is, for the diſtinguiſhing the Male from the Female

Sex, which otherwiſe could hardly be known, if both were dreſſed in the ſame Habit.

SECT. VI.

Of the Fat.

UNderneath the Skin there lies a Membrane called the *Membrana Adipoſa*, which, by the Help of a Microſcope, appears to be compoſed of an infinite Number of fine tranſparent Veſicles, or Bladders, into which the Blood-Veſſels that are ſpread upon them depoſite the oily and ſulphureous Part of the Blood, which in theſe membranous Cells we call Fat.

The Veſſels of the Fat.

Malpighius mentions a Net of ſmall Veſſels, which he calls *Ductus Adipoſi*, becauſe they are full of Fat; theſe he ſuppoſes bring the Fat into the Cells; but he could never diſcover from whence they take their Riſe. There are alſo a Number of little Glands, which are accompanied with lymphatic Veſſels, which carry back any Seroſity that is ſuperfluous.

Two Sorts of Fat.

The Fat is to be found immediately under the Skin, in all the Parts of the Body, except in the Forehead, Eye-lids, Lips, Upper-part of the Ear, Yard, and *Scrotum*. In ſome the Veſicles of the *Membrana Adipoſa* are ſo full, that the Fat is an Inch or more thick; and in others they are almoſt flat, containing little or no Fat. There are two Sorts of Fat, one white, or rather yellow, ſoft and lax, which is eaſily melted, called

Pinguedo; another white, firm, brittle, and which is not eaſily melted, called *Sevum,* or Tallow. Some reckon the Marrow of the Bones for a third Sort of Fat.

The Uſe of the Fat. The chief Uſe of the Fat is to blunt and ſweeten the too great Sharpneſs and Acrimony of the Salts which are in the Blood. It ſerves alſo to moiſten and ſupple the Parts for facilitating their Motion; to fill up the Interſtices of the Parts, that the Skin may be ſmooth and beautiful; to defend the Body againſt external Cold; and, in fine, to hinder too great a Diſſipation of the Spirits.

SECT. VII.

Of the Membrana Adipoſa, Carnoſa Communis, *and* Propria Muſculorum.

What a Membrane is. A Membrane is a Web of ſeveral Sorts of Fibres interwoven, for the covering and wrapping up of ſome Parts. Their Membranous Fibres give them an Elaſticity, whereby they can contract and cloſely claſp the Parts they contain; and their Nervous Fibres give them an exquiſite Senſe, which is the Cauſe of their Contraction; therefore they can ſcarcely ſuffer the Sharpneſs of Medicines, and they are difficultly united, when wounded. In their Texture, they are a Number of ſmall Glands, which ſeparate an Humour fit for moiſtning the Parts which they contain. By reaſon of the Thickneſs and Tranſparency of the Membranes, the Ramification of the Blood-veſſels is more apparently to be ſeen in them, than in any other Part of the Body: Here the innumerable Diviſions, Windings and Turnings, Serpentine Progreſſions and frequent Inoſculations, not only of Veins and Arteries together, but alſo of Veins with Veins, and Arteries with Arteries, make a moſt agreeable Embroidery and delicate Net-work, covering the whole Membrane. Nor is Nature always conſtant to the ſame Diſpoſition, but delights in Variety here, as well as in the Diſpoſition of the Branches and Leaves of Plants and Trees. Thoſe that cover the ſolid Parts, are properly called Membranes; and they have their particular Names, as the *Peritonæum*, which wraps up all that is contained in the *Abdomen;* the *Pleura,* that which is in the *Thorax;* the *Perioſtæum,* the Bones; and the *Pericardium,* the Heart. Thoſe which form the Coats of Veſſels, and which contain the Humours, as thoſe of the Veins, Arteries, Stomach, Bladder, Inteſtines, Teſticles, *&c.* are called Tunicles, or Coats: And thoſe which cover and embrace the Brain, as the *Dura,* and the *Pia Mater,* are called *Meninges.* Of all thoſe Kinds of Membranes, ſome are thin, and ſome are thick; and the ſame Membrane is thick in ſome Places, and thin in other Places, as in the *Membrana Adipoſa,* which is thicker in the Neck than in any other Part of the Body. The Uſe of the Membranes is to cover and wrap up the Parts; to ſtrengthen them; to ſave them from external Injuries; to preſerve the natural Heat; to join one Part to another; to ſuſtain ſmall Veſſels, and the Nerves which run through their Duplicatures; to ſtop the returning of

A Diſtinction of Membranes.

The Uſe of the Membranes.

the Humours in their Veſſels, as the Valves ſtop the returning of the Blood in the Veins and Heart; of the Chyle in the Lacteals and Thoracick Duct; and of the *Lympha*, in the Lymphatick Veſſels.

The Membrana Adipoſa *and* Carnoſa.

By the *Membrana Adipoſa*, is moſt commonly underſtood that Part of it only which lies next the Fleſh, and which contains but little Fat in its Cells; and therefore appearing more membranous than the reſt, is ſaid to be the Baſis of the *Cellulæ Adipoſæ*. And even ſome Part of this hath been taken by Anatomiſts for the *Membrana Carnoſa*, upon the account of its Redneſs; for here the Blood-veſſels ly very thick, the Veſicles not being diſtended with Fat.

Of the Membrana Communis Muſculorum.

Anatomiſts do generally aſſert, that there is a *Membrana Communis Muſculorum*, being led into that Miſtake by the *Aponeuroſis* of ſeveral Muſcles; whereas, upon ſtricter Obſervation, there is no ſuch Thing to be found.

Of the Membrana Propria Muſculorum.

The *Membrana Propria Muſculorum* is that which covers immediately all and every one of the Fibres of a Muſcle, and is cloſely tacked to them.

Of the Membrana Communis Vaſculorum.

There is another called *Membrana Communis Vaſculorum*, which is a thin Membrane, and accompanies almoſt all the Veſſels of the Body. All theſe Membranes receive Veins, Arteries and Nerves from the Parts which are neareſt to them.

CHAP.

CHAP. II.

Of the Lower Belly.

SECT. I.

Of the Muſcles in general.

The Definition of a Muſcle.

A Muſcle is a Bundle of fleſhy and often tendinous Fibres, of which all in the ſame Plane are parallel to one another, and they are all encloſed by one proper Membrane. The fleſhy Fibres compoſe that Part which is called the Body or Belly of the Muſcle; they are red, lax, and ſpongious, containing a Number of ſmall Cavities; they are tied together by a Number of ſmall and ſhort Threads, which go from Fibre to Fibre, called Membranous Fibres. The Tendinous Fibres compoſe the two Extremities; they are called Head and Tail, or the two Tendons of the Muſcle; they are white, hard, compact, and cloſely bound together, which makes them leſs than the Body of the Muſcles. In every Tendon there are as many tendinous Fibres, as there are fleſhy Fibres in the Body of the Muſcle; ſo that every fleſhy Fibre anſwers at both Ends to a tendinous Fibre, to which they are always joined obliquely, making equal and alternative Angles.

Of the fleſhy Fibres.

Of the Tendinous Fibres.

The Diviſion of Muſcles.

Muſcles are either Simple or Compoſed; the Simple have all their Fibres parallel, and in the ſame Direction; the Compoſed have the fleſhy Fibres of ſeveral Planes croſſing one another, or of different Directions; and they may be divided into as many Simple Muſcles as there are Planes, whoſe Fibres have different Directions. Each Plan reſembles a *Rhomboides*, or Lozenge. The Strength of a Muſcle conſiſts in the Number of its Fibres. The Tendons are ſometimes double and triple, as the *Biceps* and *Triceps*. Sometimes ſeveral Muſcles join in one Tendon, as the *Tendo Achillis*. Sometimes one Muſcle has two Bellies, as the *Digaſtricus*.

We find alſo Muſcles without Tendons, as the *Quadratus* of the Fore Arm, and ſeveral of the Face, Tongue, and Lower Jaw; and they are only inſerted into the *Perioſtæum*: Whereas thoſe that have Tendons are inſerted into the Body of the Tone. There are others which have only Tendons at one End, as may be ſeen in the *Myology*. This makes me ſuſpect that Tendons are only for the Conveniency of having a great Number of Fibres inſerted about a ſmall Bone. Thoſe who would have a more particular Deſcription of a Muſcle, may conſult *Steno* and *Borelli*.

Each Muſcle, and every Fibre in a Muſcle, has Nerves, Veins, and Arteries, either of which being tied, deprives the Muſcle of the Power of contracting; but the Stoppage being removed, they contract again, and contracting ſwell; ſo that the Action of the Muſcles is performed by the Rarefaction of the Blood and Spirits diſtending the Cavities of the Fibres.

This Rarefaction of the Blood and Spirits, we ſuppoſe to be performed after this Manner.

ner. The Blood is full of Globules of Air ſtrongly compreſſed by the ſurrounding Particles of Blood attracting one another, which therefore form a Globule or Shell of Blood, in the Middle of which is a ſmall Globule of Air, whoſe Force of Expanſion will be always proportional to the Force by which it is compreſſed. Theſe Globules continually circulating through the Cavities of the Muſcular Fibres, are mixt with the Animal Spirits; which, at our Will and Direction, drop from the Nerves into the Cells of the Fibres, and attracting the Particles of the Blood more ſtrongly than they do one another, give the encloſed Air an Opportunity of expanding itſelf, and conſequently of ſwelling the Veſicle; and each Veſicle ſwelling at the ſame Time, the whole Fibre muſt be ſhortned; and the ſhortning of all the Fibres is the Contraction of the Muſcle.

Though the Contraction of the Fibres be conſiderable, yet the Swelling is ſcarcely ſenſible, by reaſon of the Smalneſs of the Cavities of the Fibres. For each Fibre reſembles a String of Bladders, each of which being blown up ſingly, will raiſe a Weight to ſome determined Height; and if the whole String of ſimilar and equal Bladders be blown up together, the Space through which the Weight will riſe will be proportional to the Number of Bladders, or Length of the String or Fibre of the Muſcle. Now, though the Swelling of a large Bladder required to raiſe a Weight to ſome conſiderable Height, muſt be very great; yet ſeveral ſmall Bladders will do the ſame Thing with a Force and Swelling leſs in any given Proportion. For ſuppoſe a Bladder of a determined Bigneſs can raiſe a Weight a Foot, a hundred Bladders, whoſe Diameters are each one hundred Part of the former, being blown up, will raiſe the Weight to the ſame Height; but the Force of Inflation, and the Swelling of all put together, will be a thouſand Times leſs than in the large one. And thus we ſee how mechanically the Structure of the Fibres contributes to the Contraction of the Muſcles, with a very inconſiderable Force and a Swelling almoſt imperceptible.

SECT. II.

Of the Muſcles of the Lower Belly.

Obliquus Externus.

HAving raiſed the Skin and Fat, the Muſcles of the Lower Belly appear, which are five Pair in Number; The firſt of which that preſents itſelf, is the *Obliquus Externus* or *Deſcendens*; it takes its Origination from the two laſt true, and the five falſe Ribs, by five or ſix Digitations, the four uppermoſt of which ly between the Teeth of the *Serratus Anticus Major*; its Fibres deſcending obliquely, are inſerted all along the *Linea alba* under the *Muſculi Recti*, to the Upper and Forepart of the Spine of the *Ilium*, and to the Fore-part of the *Os Pubis*. It has a large *Aponeuroſis*, or tendinous Expanſion, which covers both itſelf, and the *Muſculi Recti*. The *Linea Alba* is a Line which reaches betwixt the *Cartilago Xiphoides* and the *Os Pubis*,

bis, made by the Union of the Tendons of the oblique and tranſverſe Muſcles, dividing the *Abdomen* in two in the middle. This Muſcle receives a Twig of a Nerve from the Intercoſtals at each of its Digitations.

Obliquus Internus.

The ſecond Pair is the *Obliquus Aſcendens* or *Internus*, whoſe Fibres are diſpoſed in a contrary manner, croſſing the former obliquely; they ariſe with a large and fleſhy Beginning from the Circumference of the *Ilium*, from the *Os Pubis*. Above they are fixed to the Cartilaginous Part of the falſe Ribs, and they are inſerted all along the *Linea Alba*.

Tranſverſalis.

The third Pair is the *Tranſverſalis*: it lies under the two former; it ariſes from the *Cartilago Xiphoides*, from the Extremities of the falſe Ribs, from the tranſverſe *Apophyſes* of the *Vertebræ* of the Loins; it is fixed to the inner Side of the Spine of the *Ilium*, and is inſerted in the *Os Pubis*, and *Linea Alba*.

Theſe three Muſcles unite their Tendons as they approach the *Linea Alba*; they are pierced in the Middle of the *Linea Alba*, for the Paſſage of the umbilical Veſſels. They are alſo pierced above the *Os Pubis*, for the Paſſage of the Spermatick Veſſels in Men, and the round Ligaments of the Womb in Women. Theſe Holes are not oppoſed to one another; that which is in the Tranſverſal is higheſt, that in the *Obliquus Aſcendens* is a little lower, and that in the *Obliquus Deſcendens* loweſt. It is this laſt which is only cut in the Operation of the *Bubonocele*; it has a fine and thin Membrane that cloſes exactly its Ring or Hole, through which the Veſſels paſs.

The

Rectus.

The fourth Pair, which is covered with the *Aponeuroſis* of the *Obliqui*, is the *Muſculus Rectus;* it ariſes from the *Sternum*, the Extremity of the laſt two true Ribs, and goes ſtrait down the Fore-part of the *Abdomen* to be inſerted in the *Os Pubis*. This Muſcle has three or four Innervations, or rather tendinous Coarctations of its fleſhy Fibres, which divide the Belly of this Muſcle, as it were, into ſo many diſtinct Muſcles. It has Veins and Arteries, which creep in its Inſide, from the Mamillary and the Epigaſtric Veſſels, which communicate, that the Blood may return by the Mamillary Veins, when the Paſſage is ſtopt by the Epigaſtrick, which are compreſſed in Women big with Child.

Pyramidalis.

The fifth Pair is the *Pyramidalis*, ſo called becauſe of their Figure; they riſe with a fleſhy Beginning, from the outer and upper Part of the *Os Pubis*, and growing narrower and narrower, are inſerted in the *Linea Alba*, ſometimes near to the Navel. Sometimes one, and ſometimes both of theſe Muſcles are wanting.

The Uſe of theſe Muſcles.

The Uſe of theſe Muſcles is, to compreſs all the Parts contained in the *Abdomen;* by which Compreſſion, the Motion of the ſeveral Fluids through their Veſſels in general, is promoted, and particularly that of the Chyle through the Lacteal Veſſels; the Stomach diſcharges itſelf in Vomiting of what is offenſive to it, and the *Rectum*, of the Excrements it contains; in Expiration the Aſcenſion of the Midriff, and Deſcenſion of the Ribs by the oblique Muſcles are facilitated; the Diſtention of the Inteſtines beyond their natural

Tone is prevented: For, without this Compreſſion upon the Inteſtines, the Air in their Cavity being rarified by the Heat of the Body, muſt have ſtretched them to ſuch a Degree as to have ſtopt both their Periſtaltick Motion, and the Circulation of the Blood in their Veſſels. By their Contraction the Trunk of the Body is bent forwards, and by the Contrivance of their Fibres decuſſating one another, every Point of the Lower Belly is ſufficiently compreſſed, ſo as that the Inteſtines can ſlip no where from the Compreſſion.

SECT. III.

Of the Peritonæum.

Its Deſcription.

IMmediately under the Muſcles of the Lower Belly appears the *Peritonæum*. It is a thin and ſoft Membrane, which incloſes all the Bowels contained in the Lower Belly, covering all the Inſide of its Cavity. Its external Superficies is unequal where it adheres to the tranſverſe Muſcles. The Internal is very ſmooth and poliſhed. It has a Number of ſmall Glands that ſeparate a Liquor which ſupples the Inteſtines, and facilitates their Motion. When theſe Glands are obſtructed, the *Peritonæum* grows thick, as may be ſeen in ſeveral Dropſies.

The upper Part of this Membrane covers the Midriff, to which it cloſly adheres; the fore Part of it ſticks to the tranſverſe Muſcles and *Linea Alba;* the lower Part of it to the *Os Pubis;* and the back Part of it to the *Os Sacrum,* and *Vertebræ* of the Loins. It is a double Membrane, and contains in its Duplicatures the Umbilical Veſſels, the Bladder, the Ureters, the Kidneys and the Spermatick Veſſels, to all which it gives a Membrane, as alſo to the Liver, Spleen, Stomach, Inteſtines, and Womb.

Its Productions. Its external *Lamina* has two Productions, like to two Sheaths, which paſs through the Rings of the oblique and tranſverſe Muſcles in the Groin, for the Paſſage of the Spermatick Veſſels in Men, and for the round Ligaments of the Womb in Women. Theſe Productions being come to the Teſticles in Men, dilate and form the *Tunica Vaginalis.* The internal *Lamina,* which is here very thin, having accompanied the external Productions a little Way, cleaves cloſe to the Spermatick Veſſels, and round Ligaments of the Womb.

Its Veſſels. The *Peritonæum* has Veins and Arteries from the *Phrenicæ,* from the Mammillary, the Epigaſtrick, and often from the Spermaticks. Its Nerves are of thoſe which are diſtributed in the Muſcles of the *Abdomen.* It has likewiſe a few Lymphaticks, which diſcharge themſelves into the Iliack Glands. By the Elaſticity of its Fibres, it eaſily dilates and contracts in Reſpiration and Conception. If it breaks, it cauſes a Rupture either in the Groin or Navel. Its Uſe is to contain the Bowels of the *Abdomen,* and to give each of them an outer Coat.

SECT.

SECT. IV.

Of the Omentum.

WHEN the *Peritonæum* is cut, as is uſual, and the Cavity of the *Abdomen* laid open, the *Omentum,* or Cawl, preſents itſelf firſt to View. This Membrane, which is like a wide and empty Bag, covers the greateſt Part of the Guts. Its Mouth is tied in the right Side to the Hollow of the Liver, in the left to the Spleen, backwards to the back Park of the *Duodenum,* and that Part of the *Colon* which lies under the Stomach, and forwards to the Bottom of the Stomach and *Pylorus.* Its Bottom is looſe, and being tied to no Part, but floating upon the Surface of the Guts, below the Navel, was the Reaſon why the Cawl was by the *Greeks* called Επίπλοον. Sometimes it deſcends as low as the *Os Pubis,* within the Productions of the *Peritonæum,* cauſing an *Epiplocele.*

Its Deſcription.

Now the Cawl is a moſt delicate and fine double Membrane, interlarded, for the moſt Part, with a great deal of Fat, which lines each Side of its Blood-Veſſels. Theſe are Veins from the *Portæ,* called, *Gaſtroepiplois dextra & ſiniſtra,* Arteries from the *Cœliaca.* The intercoſtal Nerve, and the *Par Vagum,* ſend it ſeveral Twigs of Nerves. All theſe Veſſels, with ſome ſmall Glands accompanying one another, ſpread their Branches very curiouſly upon the Cawl, and even to the minuteſt Twig; they run between two Lines of Fat, which are bigger, or ſmaller, according to the Weight of the Cawl. It has been ſometimes found to weigh five Pounds, but ordinarily it does not much exceed half a Pound. Where there are no Veſſels, the Membrane of the Cawl is very fine and tranſparent.

Its Uſe. They give ſeveral Uſes to the Cawl, as to cover the Bottom of the Stomach and the Inteſtines, that, by cheriſhing their Heat, it may promote Digeſtion, and help the Concoction of the Chyle; to ſtrengthen and ſuſtain the Veſſels which go from the Spleen to the Stomach, Inteſtines, Pancreas and Liver; to keep a Store of the Fat, that it may be received by the Veins and Lymphaticks, for the Uſe we have ſpoken of; to greaſe the Superficies of the Guts, for facilitating their Periſtaltick Motion.

SECT. V.

Of the Oeſophagus.

Though the *Oeſophagus* and *Ductus Thoracicus* lie not in the Lower Belly; yet, that I may at once ſhew the entire Paſſage of the Aliments from the Mouth to the Blood, I ſhall deſcribe them both in this Chapter.

Its Situation. The *Oeſophagus*, or Gullet, is a long, large, and round Canal, which deſcends from the Mouth, lying all along betwixt the Windpipe and the Joints of the Neck and Back, to the fifth Joint of the Back, where it turns a little to the right, and gives Way to the *Aorta Deſcendens*, and both run by one another,

nother, till at the ninth the *Oeſophagus* turns again to the left; climbs above the *Aorta*, and deſcending above it, it pierces the Midriff, and is continued to the left Orifice of the Stomach.

Its Coats. The Gullet is compoſed of three Coats. The firſt and outermoſt is only a common membranous Integument, which ſeems to be a Continuation of the *Pleura*.

The ſecond is thick and fleſhy, and conſiſts of two Orders of Muſcular Fibres, longitudinal and circular, the firſt covering the laſt; theſe thruſt the Aliments down into the Stomach. In Brutes, becauſe the Situation of their Neck conduces little to the Deſcent of the Aliments, therefore theſe Fibres run in two cloſe ſpiral Lines which croſs one another: But in Men, whoſe Poſition is erect, the very Gravity of the Aliments helps their Deſcent.

The third and laſt Line is in the Cavity of the Gullet. 'Tis compoſed of white and ſlender Fibres diverſly interwoven. At its upper End it is continued to the Membrane that covers the Mouth and Lips; therefore, in Vomiting, theſe Parts are affected. Its lower End covers the left Orifice of the Stomach two or three Fingers Breadth. The Surface of this Membrane is beſmeared with a ſoft and ſlimy Subſtance, which probably comes from ſome ſmall Glands that ly between this Coat and the ſecond.

The Muſcles of the Pharynx. The upper End of the Gullet is called *Pharynx*. It has two Pair of Muſcles for its Motion. The firſt is the *Stylo-Pharyngæus*. This is a ſmall and round Muſcle, which ariſes fleſhy from the Root of the *Proceſſus Styloides*, and deſcending obliquely, it is inſerted into the Sides of the *Pharinx*. When this Muſcle acteth, it pulleth up and dilateth the *Pharynx*, in Deglutition.

The ſecond is the *Oeſophagus*. Its Fibres have ſeveral Directions; its ſuperior Fibres ariſe from the *Proceſſus Pterigoidæus* of the *Os Sphænoides*, and from the *Cornua* of the *Os Hyoides*, and run obliquely to the back Part of the *Pharynx*. The Fibres which are below theſe ariſe from the Sides of the *Cartilago Scutiformis*, and run tranſverſly to the Middle of the back Part of the *Pharynx*, where both ſuperior and inferior Fibres from both Sides unite and form a tendinous Line. When this Muſcle acts, it draws the back Part of the *Pharynx* to its fore Part; by which it not only ſtraitens it for the depreſſing of the Aliment, but it compreſſes alſo the *Tonſillæ*, which ſend out their Liquor which lubricates the Aliment, whereby it glides the more eaſily down into the Stomach.

Its Glands. There are two Lymphatick or Verſicular Glands which are tied on the back Side of the Gullet about the fifth *Vertebra* of the Back, by the Branches of Nerves which come from the eighth Pair. Theſe two Glands are like two Kidney-beans tied together; they receive Veins and Arteries from the *Coronariæ*, and they have Lymphatick Veſſels which diſcharge themſelves into the Thoracick Duct. *Bartholine* remarks, that theſe Glands ſometimes ſwell ſo big, as to hinder the Deſcent of the Aliments into the Stomach.

The Gullet at its upper End receives an

Artery from the *Aorta*, and it ſends a Vein to the *Azygos*: At its lower End it has an Artery from the *Cœliaca*, and it gives a Vein to the *Coronaria* of the Stomach. Its Nerves are from the eighth Pair.

Its Uſe.

The Uſe of the Gullet is to carry the Meat from the Mouth into the Stomach, by means of the Muſcles of the *Pharynx*, and fleſhy Fibres of the *Gula*, which perform its Periſtaltick Motion.

SECT. VI.

Of the Stomach.

Its Situation.

Its Figure.

Its Orifice.

THE Stomach, *Ventriculus*, or Γάστηρ, lies immediately under the Midriff; the Liver covers a Part of its right Side, the Spleen touches it on the left Side, and the *Colon* at its Bottom, to which alſo the Cawl is tied. Its Figure reſembles a Bagpipe, being long, large, wide, and pretty round at the Bottom, but ſhorter, and leſs convex on its upper Part, where it has two Orifices, one at each End, which are ſomewhat higher than the Middle between them. The left Orifice is called καρδία; to it the *Oeſophagus* is joined. By this Orifice the Aliments enter the Stomach, where, being digeſted, they aſcend obliquely to the *Pylorus*, or right Orifice, which is united to the firſt of the Inteſtines. At this Orifice the Tunicles of the Stomach are much thicker than they are any where elſe, and the inmoſt has a thick and ſtrong Duplicature in Form of a

Ring, which ſerves as a Valve to the *Pylorus* when it contracts and ſhuts.

Its Coats. The Stomach is made of four Membranes or Coats. The firſt and inmoſt is made of ſhort Fibres which ſtand perpendicularly upon the Fibres of the next Coat; they are to be ſeen plainly towards the *Pylorus*. When the Stomach is diſtended with Meat, theſe Fibres become thick and ſhort. Whilſt they endeavour to reſtore themſelves by their natural Elaſticity, they contract the Cavity of the Stomach, for the Attrition and Expulſion of the Aliments. This Coat is much larger than the reſt, being it is full of Plaits and Wrinkles, and chiefly about the *Pylorus*: Theſe Plaits retard the Chyle, that it run not out of the Stomach before it be ſufficiently digeſted. In this Coat there are alſo a great Number of ſmall Glands, which ſeparate a Liquor which beſmears all the Cavity of the Stomach, and helps the Concoction of the Aliments; therefore this Coat is called *Tunica Glanduloſa*.

The ſecond is much finer and thinner; it is altogether nervous; it is of an exquiſite Senſe, and it is called *Nervoſa*.

The third is Muſcular, being made of ſtrait and circular Fibres; the ſtrait run upon the upper Part of the Stomach, between its ſuperior and inferior Orifices; and the circular run obliquely from the upper Part of the Stomach to the Bottom. Of theſe the innermoſt deſcend towards the right Side, and the outermoſt towards the left; ſo that by their Action both Ends of the Stomach are drawn towards its Middle, and the whole is equally contracted; by their Contraction and continual Motion, the Attrition and Digeſtion of the Aliments is in a great Meaſure performed.

The fourth Tunicle is common, it comes from the *Peritonæum.*

Its Veſſels. The Stomach ſends Veins to the *Porta,* *viz.* the *Gaſtrica, Pylorica,* and *Vas Breve,* and Branches to the *Gaſtro-epiploïs dextra & ſiniſtra* which are accompanied with Branches of the *Arteria Cœliaca,* all which ly immediately under the fourth Coat of the Stomach.

The eighth Pair of Nerves, or *Par Vagum,* gives two conſiderable Branches to the Stomach, which deſcending by the Sides of the Gullet, divide each into two Branches, the External and Internal. The two External Branches unite in one, and the Internal do ſo likewiſe; both which piercing the Midriff, form, by a great Number of ſmall Twigs, upon the upper Orifice of the Stomach, a *Plexus;* and then the Internal Branch ſpreads itſelf down to the Bottom of the Stomach; and the External Branch ſpreads itſelf upon the Inſide, about the upper Orifice of the Stomach. This great Number of Nerves which is about the upper Orifice, renders it very ſenſible; and from them alſo proceeds the great Sympathy betwixt the Stomach, Head, and Heart; upon which Account *Val Helmont* thought, that the Soul had its Seat in the upper Orifice of the Stomach.

The *Plexus Nervoſi* of the *Hypochondria* and *Meſenterium* give ſeveral Branches to the Bottom of the Stomach, therefore, in Hyſterick and Hypochondriack Paſſions, the Stomach is alſo affected.

Its Uſe. The Uſe of the Stomach is Digeſtion which is the Diſſolution or Separation of the Aliments into ſuch minute Parts as are fit to enter our Lacteal Veſſels, and circulate with the Maſs of Blood: Or it is the ſimple breaking of the Coheſion of all the little *Moleculæ* which compoſe the Subſtances we feed upon. Now the principal Agents employed in this Action are, firſt, the *Saliva*, the *Succus* of the Glands in the Stomach, and the Liquors we drink; whoſe chief Property is to ſoften the Aliments, as they are Fluids, which eaſily enter the Pores of moiſt Bodies, and ſwelling them, break their moſt intimate Coheſions. And how prodigious a Force Fluids acting in ſuch a Manner have, we may learn from the Force that Water, with which a Rope is wetted, has to raiſe a Weight faſtned to, and ſuſtained at one End of it: And this Force is much augmented by the *Impetus* which the Heat of the Stomach gives to the Particles of the Fluids; nor does this Heat promote Digeſtion only thus, but likewiſe by rarifying the Air contained in the Pores of our Food, which burſts its Parts aſunder. And therefore ſuch Liquors as are moſt fluid, or whoſe Particles have the leaſt Viſcidity, are moſt proper for Digeſtion; becauſe they can the more eaſily inſinuate themſelves into the Pores of our Aliments; and, of all other, Waters ſeem the fitteſt for this Uſe; for though ſome ſpirituous Liquors may as eaſily penetrate the Subſtances we feed upon, yet they have another Property, by which they hurt rather than help Digeſtions; and that is, their Particles have a ſtrong attractive Force, by which, when imbibed into the Subſtance of our Victuals, they draw their Parts nearer to one another, contract and harden, inſtead of ſwelling and diſſolving them. It is by this Property that they preſerve Animal and Vegetable Subſtances from corrupting; not but that we find they ſometimes help Digeſtion, yet not by diſſolving the Aliments, but as they irritate and excite the Coats of the Stomach to a ſtronger Contraction; and therefore, when they are duly diluted, they may be not only uſeful but requiſite. But certainly ſtrong Liquors alone are moſt unfit for Digeſtion, eſpecially ſuch as are likewiſe viſcid; and what ſad Effects they have upon the Stomach itſelf, they are truly ſenſible, who, by a long Uſe of them, have loſt their Appetite, hardly to be reſtored without the drinking of Waters, which ſeldom fail of procuring a good Appetite and ſtrong Digeſtion. When the Aliments are thus prepared, their Parts are ſoon ſeparated from one another, and diſſolved into a Fluid with the Liquors in the Stomach, by the continual Motion of its Sides, whoſe abſolute Power is, by that great Improver of the true Theory of *Phyſick*, the learned *Pitcairne*, demonſtrated to be equal to the Preſſure of 117088 Pound Weight: To which if we add the abſolute Force of the *Diaphragma*, and Muſcles of the *Abdomen*, which likewiſe conduce to Digeſtion, the Sum will amount to 250734 Pound Weight. Theſe two Actions we ſee more clearly in

Birds, becauſe they are performed in two Stomachs. In the firſt, the Corn is only ſwelled and ſoftened by the Liquor of its Glands, but broken and diſſolved in the ſecond, which is compoſed of very ſtrong Muſcles, becauſe thoſe of the *Abdomen* and *Diaphragma* are weak, neither do they act upon the Stomach, as in Men.

SECT. VII.

Of the Inteſtines and Meſentery.

What the Guts are.

WHEN the Aliments are ſufficiently diſſolved in the Stomach, they are by its Muſcular Fibres thruſt out into the *Inteſtines*, or Guts. Now the *Inteſtines* are a long and large Pipe, which by ſeveral Circumvolutions and Turnings, reaches from the *Pylorus* to the *Anus*. They are knit all along to the Edge of a Membrane called the *Meſentery*, and are ſix Times as long as the Body to which they appertain; that the Chyle which eſcapes the Lacteals of one Part of the Guts, may be taken up by thoſe in the next. They are compoſed of three Coats, of which the firſt and inmoſt is made up of ſhort Fibres bound together by fine Blood-Veſſels, and diſpoſed as thoſe of the Stomach; for the Length of the Fibre is the Thickneſs of the Coat. *Leeuwenhock* firſt obſerved theſe Fibres with his Glaſſes: But, if you carefully inject the Meſenterick Artery with warm Water, they will ſeparate from one another, and become viſible to the naked

Their Coats.

naked Eye. They act after the ſame Manner as thoſe of the inner Membrane of the Stomach, for the contracting of the Cavity of the Guts. This Coat being much longer than the others, lies in Wrinkles or Plaits, called *Valvulæ-Conniventes*, which in the ſmall Guts form larger Segments of Circles, and are cloſer to one another, than in the great Guts, where they are broader, and ſeem to be chiefly deſigned to ſuſtain the Weight of the *Fæces*; whereas the others, by retarding the Motion of the Chyle, and by directly oppoſing the Mouths of the Lacteal Veſſels (which are in the upper Side of the Valves) to its Paſſage, give it a more favourable Opportunity, and better Chance for entring, than otherwiſe it would have. This Coat has likewiſe a great Number of little Glands, which in the ſmall Guts lie in Cluſters every where but where they are knit to the Meſentery: In the great Guts they are much fewer, and are placed at ſome Diſtance from one another. The Uſe of theſe Glands is diſputed: Some think that they ſeparate the Slime which beſmears the Inſide of the Inteſtines, to defend them againſt the Acrimony of the Bile; but this more probably comes from ſome Remainder of the Chyle. Others take them for the Mouths of the Lacteal Veſſels: But there are many Lacteals where there are no Glands. If we conſider, that they are moſt chiefly placed where the Lacteals are moſt numerous, we cannot but think that they ſeparate a Liquor for diluting of the thick Chyle, that it may

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the more eaſily enter the narrow Orifices of the Lacteal Veins.

The ſecond Coat is made up of two Orders of Muſcular Fibres; of which one runs ſtraight, according to the Length of the Guts; the other goes round, and its Fibres are more reaſonably thought to deſcribe a Spiral Line, than Circles. For if, as ſome imagine, theſe Fibres were not ſpiral, but circular, it is not eaſy to conceive, how that conſtant and uniform Vermicular, or Wave-like Motion of the Inteſtines, could be tranſmitted from Part to Part by Fibres, which had no Communication with one another, but which, having once ſurrounded the Gut, are at both Ends fixed to the Edge of the Meſentery; whereas now, by the ſucceſſive Motion of the Parts of theſe two Orders of Fibres, the Guts are in a continual Undulation, which is called their Periſtaltick Motion.

The third and external Coat is common, it cometh from the *Peritonæum*.

The Diviſion of the Guts.

Though the Inteſtines be one continued Pipe, yet Anatomiſts divide it into ſix Parts, three thin and ſmall, and three thick and great. The three thin and ſmall are, the *Duodenum*, *Jejunum*, and *Ilium*. The *Duodenum* is the firſt Part of the Inteſtines; it is about twelve Fingers Breadth long; it is continued to the *Pylorus*, from which, turning downwards, it runs under the Stomach immediately above the *Vertebræ*, towards the left Side, and ends at the firſt of the Windings, under the *Colon*. At its lower End there are two Canals, which open in its Cavity; one comes from the Liver and Gall-Bladder,

Of the Duodenum.

Bladder, called *Ductus communis Choledochus*; the other from the *Pancreas*, called *Ductus Pancreaticus*. The firſt brings the Bile; the ſecond the *Succus Pancreaticus* into this Inteſtine. It differs from the other two in this, that its Paſſage is ſtraiter, and its Coat thicker.

Of the Jejunum.

The ſecond is the *Jejunum*; it begins at the firſt Winding of the Guts under the *Colon*, where the *Duodenum* ended; and making ſeveral Turnings and Windings from the left Side to the right, and from the right again to the left, it is continued to the *Ilium*, filling all the upper Part of the Umbilical Region, being about 12 or 13 Hands Breadth long. It differs from the *Ilium* only in this, that it hath ſome more *Venæ Lacteæ*, into which the Chyle paſſing, it is found always more empty, therefore it is called *Jejunum*: And the Folds of its inner Coat are nearer to one another, and in greater Number than in the *Ilium*.

Of the Ilium.

The third and laſt of the ſmall Guts is the *Ilium*, it is about 21 Hands Breadth long; it begins where the *Jejunum* ends, and making ſeveral Turnings and Windings, it fills all the lower Part of the Umbilical Region, and all the Space betwixt the *Ilia*, and is continued to the Beginning of the *Colon* at right Angles; its Paſſage is a little narrower than that of the *Jejunum*, and its Coats ſeem ſomewhat thinner.

This Inteſtine, becauſe of its Situation, falls eaſily down into the *Scrotum*, by the Productions of the *Peritonæum*. In it alſo happens the *Volvulus*, when one Part of this Gut enters the Cavity of the Part immediately above or below.

The thick and great Guts are, *Cæcum*, *Colon* and *Rectum*.

Of the Cæcum. The *Cæcum*, although ſmall, yet is taken for the firſt of the great Guts; but the Antients, who made this Diviſion of the Guts, called the Beginning of the *Colon*, the *Cæcum*; and what is now called *Cæcum*, they called *Appendix Cæci*. It is four or five Fingers Breadth long, and about the Bigneſs of a Swan's Quil. It is called *Cæcum*, becauſe it is open only at one End, by which it is tied to the Beginning of the *Colon*, to which it ſeems to be an Appendage; ſo that the Excrements go in and come out at the ſame Orifice. Its other End, which is ſhut, is not tied to the Meſentery, but to the right Kidney, by means of the *Peritonæum*. Its Uſe is yet unknown. Some take it for a ſecond Stomach, others for a Receptacle of the Excrement of the *Fœtus*, in which it is always full, till after the Birth. Others ſay it contains a Ferment, and others the Flatuoſity of the Inteſtines; and others, that it ſeparates a Liquor by ſome Glands which are in its Cavity; which Liquor ſerves to harden the Excrements as they paſs through the *Colon*.

Of the Colon. The *Colon* is the greateſt and wideſt of all the Inteſtines, and about eight or nine Hands Breadths long. It begins where the *Ilium* ends, in the Cavity of the *Os Ilium* on the right Side; from thence aſcending by the Kidney of the ſame Side, it paſſes under the Concave Side of the Liver, to which it is ſometimes tied, as likewiſe to the Gall-Bladder,

der, which tinges it yellow in that Place; then it runs under the Bottom of the Stomach to the Spleen in the left Side, to which it is alſo knit; from thence it turns down to the left Kidney, and then paſſing in Form of an S, it ends at the upper Part of the *Os Sacrum* into the *Rectum*.

At the Beginning of this Gut there is a Valve formed by the Production of the inmoſt Coat of the Inteſtines in this Place; it hinders the Excrements which are once fallen into the *Colon* to return again to the *Ilium*. It has a ſtrong Ligament, which running along its upper Side from the *Ilium* to the *Rectum*, ſtrengthens it againſt the Weight of the Excrements, and draws it together into Cells, which, with the *Valvulæ Conniventes*, retard the Paſſage of the Excrements, that we may not be obliged continually to go to Stool. The fleſhy Fibres of its ſecond Coat are greater and ſtronger than thoſe of the other Inteſtines, becauſe a greater Strength was requiſite to cauſe the Excrements to aſcend. The chief Deſign of the *Colon*'s ſurrounding the *Abdomen*, and with the *Rectum*, touching all the Parts contained in it, ſeems to be, that by immediate Fomentation with Clyſters, we might eaſe them of their Maladies.

Of the Rectum.

The *Rectum* is the laſt of the Inteſtines. It is a Hand's Breadth and a half long: Its Cavity is about three Fingers in Diameter; its Coats are thicker than thoſe of the *Colon*. It begins at the upper Part of the *Os Sacrum*, where the *Colon* ends, and going ſtraight down, it is tied to the Extremity of the *Coccyx* by the *Peritonæum* behind, and to the

Of the Muſcles of the Rectum.

Neck of the Bladder in Men, and in Women to the Neck of the Womb before; from thence comes the Sympathy between theſe Parts. There is very much Fat about its external Side, therefore it is called the Fat Gut. Its Extremity forms the *Anus*, into which there are three Muſcles inſerted. The firſt is the *Spincter Ani*; this is a fleſhy Muſcle, about four Fingers broad, compoſed of circular Fibres, which embrace the Extremity of the *Rectum*, for three Fingers Height, and which hang over it another Fingers Breadth; ſo that, in the Operation for a *Fiſtula in Ano*, there is always an Inch more of this Muſcle cut than there is of the *Rectum*. It is connected forward to the *Acceleratores Urinæ* in Men, and to the Neck of the Womb in Women, and backwards to the *Os Coccygis*. Its Uſe is to ſhut the Paſſage of the *Anus*, which the Weight of the *Fæces* open.

The other two Muſcles are the *Levatores Ani*; they ariſe from the Internal and Lateral Side of the *Os Iſchii*, and are inſerted into the *Spincter Ani*. They draw the *Anus* upwards. A Palſy of the *Spincter* cauſes an involuntary running of the Excrements, and a Palſy of the *Levatores* cauſes a Deſcent of the *Anus*.

Of the Meſentery.

Now all theſe Guts lying in a little Space, are kept from entangling one another by the *Meſentery*; which is a fat Membrane, placed in the Middle of the *Abdomen*, almoſt of a circular Figure, with a narrow Production, to which the End of the *Colon* and Beginning of the *Rectum* are tied. It is about four Fingers Breadth and an half in Diameter; its Circumference being full of Plaits and Foldings, is about three Ells in Length. The *Inteſtines*, which are tied to this Circumference, are about eight or nine Ells long; ſo that to every Inch of the Circumference of the Meſentery there are three Inches of the *Inteſtines* faſtned. The Meſentery itſelf is ſtrongly tied to the firſt three *Vertebræ* of the Loins. It is compoſed of three *Laminæ*; the inner, upon which the Glands and Fat ly, and the *Veins* and *Arteries* run, is its own proper Membrane; and the other two, which cover each Side of the proper Membrane, come from the *Peritonæum*.

Of the Veſſels of the Guts.

Between the two external *Laminæ* of the Meſentery run the Branches of the *Arteria Meſenterica Superior* and *Inferior*, which bring the Blood to the *Inteſtines* and the *Venæ Meſeraicæ*, which, being Branches of the *Portæ*, carry the Blood back from the Guts to the Liver. Here all the large Branches of both *Arteries* and *Veins* communicating with one another, march directly to the Guts, where, with the *Nerves* from the *Plexus Meſentericus*, they divide into an infinite Number of ſmaller Branches, which ſpread themſelves exceeding finely upon the Coats of the *Inteſtines*.

The *Venæ Lacteæ* and Lymphatick Veſſels run likewiſe upon the Meſentery, in which there are alſo ſeveral Veſicular Glands, the biggeſt of which, in the Middle of the Meſentery, is called *Pancreas Aſellii*. Theſe Glands receive the *Lympha* and *Chyle* from the Lacteal Veins, of which next in Order.

SECT.

SECT. VIII.

Of the Lacteal Veins, Receptacle of the Chyle, and Thoracick Duct.

WHILST the groſſer Parts of the Aliments are by the Periſtaltick Motion of the Guts, by the Preſſure of the Midriff, and Muſcles of the lower Belly, thruſt out at the *Anus*; the finer Parts, or Chyle, are by the ſame Powers ſqueezed into the narrow Orifices of the Lacteal Veins.

Theſe are long and ſlender Pipes, whoſe Coats are ſo thin as to become inviſible when they are not diſtended with Chyle, or *Lympha*. They ariſe from all the Parts of the ſmall Guts by fine Capillary Tubes, which, as they run from the Sides of the Guts to the Glands in the Meſentery, unite and form larger Branches; theſe are called *Venæ Lacteæ Primi Generis*. The Mouths of theſe Lacteals, which are open into the Cavity of the Guts, from whence they receive their Chyle, are ſo ſmall as not to be ſeen by the beſt Microſcope. It was neceſſary they ſhould be ſmaller than the fineſt Arteries in the Body, that nothing might enter which might ſtop the Circulation of the Blood. The ſame Extremity of the Lacteals has likewiſe Communication with the Capillary Arteries of the Guts, by which they receive a *Lympha*, which dilutes and propels the Chyle forwards, and waſhes the Lacteals and Glands, that they may not fur, and be obſtructed by the Chyle's ſtaying in them upon faſting. The other Extremity of the Lacteals diſcharges the Chyle into the Veſicular Cells of the Glands diſperſed up and down the Meſentery: And from theſe ariſe other Lacteals of a larger Size, which carry the Chyle immediately into the *Receptaculum Chyli;* they are called *Lacteæ ſecundi Generis*. The Lacteal *Veins* have *Valves* at ſeveral Diſtances, which hinder the Chyle from returning back into the *Inteſtines*.

Of the Receptaculum Chyli.

Aſellius, who firſt diſcovered the Lacteal Veſſels, in the Year 1622, and his Followers, thought that they carried the Chyle to the Liver: till *Pequet*, in the Year 1651, found out the *Receptaculum Chyli*, and *Ductus Thoracicus;* though they both were elegantly deſcribed by the learned and accurate Anatomiſt † *Bartholomæus Euſtachius*, many Years before the Diſcovery of the Lacteal Veins.

The Receptacle of the Chyle is eaſily found in live Bodies, but with a greater Difficulty in thoſe that are dead. It lies between the deſcending Trunk of the great Artery, and the *Vertebræ* of the Loins, and is biggeſt between the *Cœliack* and *Emulgent* Arteries, ſurrounded by ſeveral Veſicular Glands, called *Glandulæ Lumbares*, which diſcharge their *Lympha* into it. Their Receptacle receives all the ſecond Order of Lacteals, as well as all the Lymphatick Veins both of the Legs, and of all the Parts contained in the *Abdomen*; ſo that indeed it ſeems to be only a Bag (which will contain about an Ounce of Water) formed by the Union of theſe Veſſels: The Bottom of it contracts to the Smalneſs of a Lymphatick Veſſel; the Middle is ſometimes divided into two or three Parts, and the upper Part ſtretches itſelf out into a Duct about the Bigneſs of a Gooſe-quill. This Duct aſcends into the *Thorax*, behind the great Artery; and, about the Heart, it frequently divides into two or three Branches, which immediately unite again into one; and, creeping all along the Gullet, it marches to the left Subclavian Vein, where it opens at one or two Orifices, which are covered with a ſemi-lunar Valve, that the Blood may paſs over them, and the Chyle run from underneath it, and mix with the Blood in the Veins. The *Ductus Thoracicus* has Valves at ſeveral Diſtances, which hinder the Chyle that has once paſſed them, from falling back. It receives the Lympheducts from the ſeveral Parts in the Cheſt, as it paſſes along to the Subclavian Vein. By its running up the left Side, the Chyle receives a new *Impetus*, from the Pulſation of the great Artery;

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† *Itaque in illis animantibus* (ſcil. Equis,) *ab hoc ipſo inſigni trunco ſiniſtro Jugali, qua poſterior ſedes radicis Venæ internæ Jugularis ſpectat, magna quædam propago germinat, quæ præterquam quod in ejus origine Oſtiolum ſemicirculare habet, eſt etiam alba & aquei humoris plena; nec longe ab ortu in duas partes ſcinditur, paulo poſt rurſus coeuntes in unam, quæ nullos ramos diffundens, juxta ſiniſtrum Vertebrarum latus, penetrato ſepto tranſverſo, deorſum ad medium uſque lumborum fertur: quo loco latior effecta, magnamque Arteriam circumplexa, obſcuriſſimum ſinem, mihique non bene perceptum obtinet.* Barth. Euſt. Antigrammate xiii. de Vena ſine Pari.

whereas, on the right Side, it muſt have aſcended only by the Preſſure of the *Diaphragma*, and Muſcles of the lower Belly upon the Receptacle, which it equally enjoys in its preſent Situation.

SECT. IX.

Of the Lymphatick Veſſels.

HAving frequent Occaſion to mention the Lymphatick Veſſels, which have no particular Source or Origination, but which almoſt all ſend their *Lympha* to the Receptacle of the Chyle and Thoracick Duct, juſt now deſcribed; I ſhall therefore give a general Deſcription of them in this Place.

The Lympheducts are ſlender pellucid Tubes, whoſe Cavities are contracted at ſmall and unequal Diſtances, by two oppoſite ſemilunar Valves, which permit a thin and tranſparent Liquor to paſs through them towards the Heart, but which ſhut, like Flood-gates, upon its returning. They ariſe in all Parts of the Body; but after what Manner, I think, needs no great Diſpute; for, without doubt, all the Liquors in the Body (excepting the Chyle) are ſeparated from the Blood in the fine Capillary Veſſels, by a different Pipe from the common Channel in which the reſt of the Blood moves: But whether this Pipe be long or ſhort, whether it be viſible or inviſible, it is ſtill a Gland, whilſt it ſuffers ſome Parts of the Blood to paſs through it, denying a Paſſage to others. Now the

Glands which ſeparate the *Lympha*, are of the ſmalleſt Kind, being inviſible to the fineſt Microſcope; But their excretory Ducts, the Lymphatick Veſſels, unite with one another, and grow larger as they approach the Heart; yet they do not open into one common Channel, as the Veins do; for ſometimes we find two or three, or more Lympheducts, running one by another, which only communicate by ſhort intermediate Ducts, or which unite, and immediately divide again. In their Progreſs they always touch at one or two Conglobate or Veſicular Glands, into which they diſcharge themſelves of their *Lympha*. Sometimes the whole Lympheduct opens at ſeveral Places into the Gland, and ſometimes it ſends in only two or three Branches, whilſt the main Trunk paſſes over, and joins the Lympheducts which ariſe from the oppoſite Side of the Glands, exporting again the *Lympha* to their common Receptacles. Now the Glands of the *Abdomen* which receive the Lympheducts from all the Parts which it contains, as likewiſe from the lower Extremities, as the *Glandulæ Inguinales, Sacræ, Iliacæ, Lumbares, Meſentericæ*, and *Hepaticæ;* all which ſend out new Lympheducts, which pour out their *Lympha* into the *Receptaculum Chyli*, as thoſe of the Cheſt, Head, and Arms, do into the *Ductus Thoracicus*, Jugular and Subclavian Veins. Theſe Glands are round and ſmooth Bodies, about the Bigneſs of a Hazel Nut, bigger or leſſer, according to the Number of Lympheducts they receive. Their Subſtance conſiſts of Membranes, which divide the whole Bulk into little Cells, which receive the *Lympha* from the Lympheducts; and therefore they are improperly called Glands, being they ſeparate no Liquor from the Blood. 'Tis true, their exporting Lympheducts communicating with their Arteries, do receive a *Lympha* from them; but this is done without the Help of the Conglobate Glands, as the Lacteal Veins do with the Capillary Arteries of the Guts; and the chief Uſe of theſe Veſicular Bodies ſeems to be, that the flow-moving *Lympha* may receive a greater Velocity from the elaſtick Contraction of their membranous Cells, as well as from the new *Lympha* immediately derived from the Arteries.

If you examine the *Lympha* chymically, you will find that it contains a great deal of volatile but no fixed Salt, ſome Phlegm, ſome Sulphur, and a little Earth.

The Uſe of the *Lympha* may be gathered from the Conſideration of the Parts into which it diſcharges itſelf. That which comes from the Head, Neck, and Arms, is thrown into the Jugular and Subclavian Veins. All the Lympheducts which the Parts in the Cavity of the *Thorax* ſend out, empty themſelves into the Thoracick Duct, and the *Lympha* from all the reſt of the Body flows to the Receptacle of the Chyle; ſo that there can be no Doubt, but that its chief Uſe is to dilute and perfect the Chyle before it mixes with the Blood. Now the whole *Lympha*, which is ſeparated from the Blood, being requiſite for this Uſe, it is plain, that there could be no Glands in the *Abdomen* appropriated for the Separation of the whole *Lympha*, but what muſt have had a very great Share of the Blood which paſſes through the *Aorta*, in order to ſeparate ſo great a Quantity of *Lympha*. But the Liver and Kidneys requiring likewiſe a great Quantity of Blood, and which could not be avoided, Nature choſe to ſeparate the *Lympha* from the Blood, which goes to all the Parts of the Body, rather than appoint particular Glands for it in the *Abdomen*, which would have been more at Hand, but which would have robbed the other Parts of a large Quantity of Blood, and occaſioned and a very unequal Diſtribution of it.

SECT. X.

Of the Glands in General.

THE modern Anatomiſts have reduced all the Glands of the Body to two Sorts, *viz.* the *Glandulæ Conglobatæ*, and the *Glandulæ Conglomeratæ*.

The Conglobate Gland.

A Conglobate Gland is a little ſmooth Body, wrapped up in a fine Skin, by which it is ſeparated from all other Parts, only admitting an Artery and Nerve to paſs in, and giving Way to a Vein and excretory Canal to come out. Of this Sort are the Glands of the Brain, the Labial Glands, and the *Teſtes*.

The Conglomerate Gland.

A Conglomerate Gland is compoſed of many little Conglobate Glands all tied together, and wrapped up in one common Tunicle, or Membrane. Sometimes all their excretory Ducts unite, and make one common Pipe, through which the Liquor of all of them runs, as the *Pancreas* and the *Parotides* do. Sometimes the Ducts uniting, form ſeveral Pipes, which only communicate with one another, by croſs Canals, and ſuch are the *Mammæ*. Others again have ſeveral Pipes, without any Communication with one another; of which Sort are the *Glandulæ Lachrymales*, and *Proſtratæ*. And a fourth Sort is, when each little Gland has its own excretory Duct, through which it tranſmits its Liquor to a common Baſon, as the Kidneys.

This much of the Fabrick of the *Glands*, we know from Diſſections: Their inward Structure, and the Manner by which they ſeparate the ſeveral Humours from the Blood, good Glaſſes and ſound Reaſoning muſt diſcover. The Antients thought that the *Glands* were Ciſterns which contained certain Liquors, by which the Blood being fermented, threw off the Humours we find in the excretory Ducts. But as theſe Ferments muſt mix with the Blood, ſo they muſt be exhauſted and carried off by the Blood into Veins. And becauſe all the Liquors in the Body are ſeparated from the Blood, there muſt therefore be another Ferment to ſeparate more: But this ſecond Ferment is liable to the ſame Fate as the firſt; and therefore there muſt be an infinite Series of Ferments in the Body, which is abſurd. If it ſhould be ſaid that the Ferments are not carried off with the Blood, they muſt be ſtopped by the Structure of the *Glands*: But then we have a Secretion without a Ferment, which is the Opinion of moſt of the Moderns; ſome of which think that the *Glands* are Tubes, whoſe Orifices differing in Figure, admit only Bodies of ſimilar Figures to paſs through them. But this Opinion is demonſtrably falſe; for beſide that Liquors are ſuſceptible of all Figures, and that Bodies of any Figure, and a leſſer Diameter than that of the Gland, will paſs through, and that even a Body of a ſimilar Figure, and equal Diameter with that of the Orifice of the Gland, may be preſented innumarable Ways, and not be able to paſs through whilſt there is only one Way it can paſs; I ſay, beſides all theſe, it is eaſy to demonſtrate, that all the Veſſels in the Body are either conical or cylindrical, and conſequently no Difference in the Figure of their Orifices: For the Preſſure of a Fluid being always perpendicular upon the Sides of the Veſſel that contains it, and equal at equal Heights of the Fluid, if the Sides are ſoft and yielding, they muſt be equally diſtended; that is to ſay, a Section perpendicular to the *Axis* of the Veſſel muſt be a Circle, and conſequently the Veſſel be either cylindrical or conical. This is agreeable to the Obſervations and Speculations of the niceſt † Anatomiſts, who tell us, that a Gland is nothing but a Convolution of ſmall Arteries, whoſe laſt Branches are cylindrical, or, which is the ſame Thing, Part of any infinitely long Cone. A Gland therefore being nothing elſe but a Branch of an Artery, whoſe fartheſt Extremity becomes the excretory Duct of the Gland, let us conſider how ſuch a Structure can ſeparate from the Blood only, ſome Parts of it; and how different Glands may ſeparate different Parts of the Blood. Firſt then, If ſuch a Fluid is to be drawn off, as conſiſts of the ſmalleſt Particles of the Blood; let that Orifice of the Gland, which is inſerted into the Artery of which it is a Branch, be ſo ſmall as to admit only the ſmalleſt Particles of the Blood; then theſe, and theſe only, will enter this Gland; and the Fluid which paſſes out at the other Extremity of the Tube, or the excretory Duct, muſt be ſuch as is required. If the Particles of the Blood, which are of the next Size or Magnitude, are required to be ſeparated, let the Orifice of the Gland be ſo big as to receive theſe ſecond Particles, but ſmall enough to exclude all bigger Particles; then theſe ſecond Particles, together with the firſt or ſmalleſt, will enter the Gland: But becauſe the Liquor to be ſecerned, is to conſiſt only of the ſecond Sort of Particles, that is, the ſecond Sort of Particles only are to flow out at the Extremity of the Tube, which is the Excretory Duct; therefore we are to ſuppoſe, that this Gland (which is only a Branch of an Artery, and differs in nothing from a common Artery, but in the Narrowneſs of its Channel) has Branches which are big enough to receive the ſmalleſt Particles only, and carry them off into the Vein; ſo that, as both Sorts of Particles move together along the Gland, the ſmalleſt Particles will paſs off through its Branches, and a Fluid, conſiſting chiefly of the ſecond Sort of Particles, will arrive at the excretory Duct. Thus the Number of

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† Nuck *and* Bellini.

Branches may be ſo great as to draw oft moſt of the ſmalleſt Particles, before the ſecond Sort of Particles arrive at the excretory Duct; ſo the Liquor to be ſecerned, may conſiſt of both theſe Sorts of Particles, mixed together, in any Proportion, according to the Number of Branches. If a Fluid, conſiſting of a third Sort of Particles, larger than either of the former, is to be ſecerned, the Orifice of the Gland muſt be juſt big enough to admit ſuch Particles, and none bigger; and the Branches of the Gland muſt be ſmall enough to exclude the biggeſt Particles, and big enough to receive the leſſer; and according as the Number of Branches is, either greater or ſmaller, the Fluid which runs out at the excretory Duct will conſiſt either of the largeſt Particles, or of all together mixed, in any Proportion. Thus we ſee, how a Liquor thicker than the Blood may be ſtrained off from the Blood, if the Orifice of the Gland be ſo big as to admit Particles of all Sizes, and the Branches ſo numerous as to draw off the thinner Part, before the thicker arrives at the Excretory Duct.

After this manner, the ſeveral Humours of the Body may be ſeparated by the Glands from the Blood, which muſt either be compoſed of ſo many Humours as are ſeparated from it, or elſe it muſt contain a few Principles, which mixed all together from the Blood, and which variouſly combined from the different Humours which are drained from it, as a few Rays of Light of different Refrangibilities mixed all together, produce a white Colour, but variouſly combined, exhibite all imaginable Variety of Colours.

It is not at all probable, that the Blood, in which we diſcern but two diſtinct Parts, ſhould be compoſed of near thirty ſimple Humours; for ſo many do the Glands ſecern from it. Nor is it agreeable to that Simplicity which Nature conſtantly affects in all her Operations. The Principles of all natural Bodies are ſaid by Philoſophers not to exceed the Number Five; and how prodigions is the Variety that reſults from their different Mixtures, and Modifications? If we ſuppoſe likewiſe but five Principles, or different Particles in the Blood, their Combinations alone, without different Modifications and Proportions, will yield near as many different Humours as are ſeparated from the Blood. Nor is this purely a Suppoſition, but it is Matter of Fact, that Urine, Sweat, Tears, Spittle and Milk, are compound Liquors, and that in each of them there are Parts common to all of them. And if the Compoſition of ſome of the other Humours of the Body is not ſo apparent, it does no more follow from thence that they are not compounded, than it does that the Blood is not, becauſe we do not perceive in it the ſeveral Humours, which by the Glands are ſeparated from it. Being therefore the ſeveral Humours are formed by the various Combinations of a few Particles which compoſe the Blood, and that each Humour is ſecerned by Glands, placed for the moſt Part in ſome one Part of the Body, as the Gall, which is ſeparated no where but in the Liver, and the Urine in the Kidneys; the Particles of the Blood muſt fall into ſuch Combinations as are fit to form Gall at the Liver, Urine, at the Kidneys, and ſo of the others; otherwiſe the Glands could never ſeparate from the Blood ſuch Humours. And being all the Humours are compoſed of a few different Particles, the greater will be the Number of Particles combined to form Bile; and the greater Quantity of Bile will be ſecerned, the fewer there are of all other Combinations at the Liver. Such Combinations therefore as are fit to form the Humours proper to paſs through the Glands, where theſe Combinations are formed, being there only requiſite, will be there moſt numerous; and all others being there leſs requiſite, or uſeleſs, will be there leſs numerous: And therefore, wherever the Particles of the Blood are moſt diſſolved, there will be placed ſuch Glands as ſeparate Humours which conſiſt of the moſt ſimple Combinations, or of Particles which do the moſt eaſily combine; and at the greateſt Diſtance from theſe, will be ſituated the Glands which ſecern Humours conſiſting of the moſt compound Combinations, or of Particles which do the moſt ſlowly unite. And between theſe will be all other Glands, nearer to either Extreme, as they ſeparate Humours more or leſs combined, or compounded of Particles which do more quickly or ſlowly combine together. By the Thinneſs of the Liquor in the *Pericardium*, and of the Urine which paſſes through the Kidneys, the Particles of the Blood ſeem to be moſt diſſolved at and about the Heart. Here we not only find the Effects of this Diſſolution in the Secretions, but likewiſe the Cauſe of the Force of the Air in Reſpiration breaking the Globules of the Blood; which Force is demonſtrable to exceed the Preſſure of 100 Pound Weight upon the Surface of the Lungs. Nor is it evident only from the Cauſe and Effects, that the Blood is here moſt diſſolved, but likewiſe from the Methods which Nature takes to prevent the Effects of this Diſſolution, in ſome particular Places at a little Diſtance from the Heart: For the Bile and Seed being thick Humours, compoſed of Particles which combine but ſlowly together, and it being requiſite that they ſhould be ſecerned where the Liver and Teſticles are placed; Nature has made Uſe of particular Contrivances, to give the Particles which were to form theſe Humours, more Time to combine, than they could have had otherwiſe, being ſo near to the Heart: For the Formation of the Bile, ſhe has contrived the *Vena Portæ*, and the Spleen; through the firſt, the Blood moves near 200 Times ſlower, and through the laſt, altogether as much, than otherwiſe it had done. And that the Particles which form the Seed might have Time to combine, the Orifices of the Spermatick Arteries are contracted, and they likewiſe ariſe from the *Vena Cava*, a little below the Emulgent, at a great Diſtance from the Teſticles, contrary to the common Courſe of Nature, by which Means the Blood is 150 Times longer in going to the Teſticles than otherwiſe it had been. At the greateſt Diſtances from the Heart, the viſcous Liquor of the Joints is ſecerned; and ſome Liquors, whoſe Parts require no Combination, as the *Lympha*, may be ſecerned any where. All theſe different Combinations, which form ſo many diſtinct Fluids, ariſe from an attractive Power in the Parts of Matter; which, though it be equally diffuſed through the whole Maſs, yet according to the different Denſities of Particles, and the Figure of their Parts, ſome Sorts of Particles will be ſoon united, whilſt others require a longer Time to be joined together; ſome Particles will cohere more firmly than others, and Particles of one Kind will have a greater Tendency to unite with thoſe of another Sort in a certain Portion of their Surface, than in any other. This attractive Force is different from that by which Sir *Iſaac Newton* explains the Motions of the Heavenly Bodies; for the Force of Attraction, by which the Planets preſerve their Motions, decreaſes only in a reciprocal duplicate Proportion of their Diſtances; whereas this other ſeems to decreaſe in a reciprocal Triplicate, or in a greater Proportion of the Diſtances of the Parts of Matter from each other. But the Cauſe of this Attraction I have more fully explained in another Diſcourſe on Animal Secretion. The narrow Limits of my Deſign will not allow me to illuſtrate this Opinion any farther. Another may be ſeen in Dr. *Cockburn's Oeconomia Animalis*, who is among the firſt who propoſed to explain Secretion, from the different Velocities of the Blood.

SECT. XI.

Of the Pancreas *and* Succus Pancreaticus.

Of the Pancreas.

THE *Pancreas*, or Sweet-Bread, is a Gland of the Conglomerate Sort, ſituated betwixt the Bottom of the Stomach and the *Vertebræ* of the Loins; it lies acroſs the *Abdomen*, reaching from the Liver to the Spleen, and is ſtrongly tied to the *Peritonæum*, from which it receives its common Membranes. It weighs commonly four or five Ounces. It is about ſix Fingers Breadth long, two broad, and one thick. Its Subſtance is a little ſoft and ſupple; every little Gland has a ſmall Excretory Veſſel, which uniting all together, form one common Duct about the Bigneſs of a Quill, clear and tranſparent, like to a Lymphatick Veſſel. This Duct runs all along the Middle of the *Pancreas*, and opens into the Cavity of the *Duodenum*, as its lower End, where there is a little Caruncle at its Orifice. Sometimes it joins the *Ductus Communis Choledochus*, and then both open at one Orifice into the *Duodenum*. This Canal was firſt found by *Virtſungus*, and is called *Ductus Pancreaticus Virtſungi*.

***Of the* Ductus Pancreaticus.**

***Of the Veſſels of the* Pancreas.**

The *Pancreas* receives Arteries from the *Cœliack*. Its Veins carry their Blood into the Splenick Branch of the *Vena Portæ*, and the Intercoſtal furniſhes it with Nerves. The Uſe of the *Succus Pancreaticus* is to dilute the Chyle with the Liquor that is ſeparated in the Glands of the Guts, that it may the more eaſily enter the Mouths of the Lacteal Veſſels.

SECT. XII.

Of the Liver and Gall-Bladder.

Its Situation. THE Liver lies in the right *Hypochondrium.* Its convex and upper Side reaches a little beyond the *Cartilago Xiphoides*, and touches the *Diaphragma.* Its concave and under Side covers the *Pylorus*, and Part of the Stomach, as alſo a Part of the *Colon*, all the *Duodenum*, a Part of the *Jejunum*, and of the *Omentum.* When we ſtand, its Extremity goes near to the Navel.

Its Figure. The Liver is almoſt round, and pretty thick. Its upper Side is convex, ſmooth, and equal; the other Side is concave, but not ſo equal. In its Middle and Fore-part it is divided into two, by a Fiſſure, where the Umbilical Veſſels enter. The Gall-Bladder is faſtned to its under Side, where there are three Eminences that the Antients called *Portæ*, of which one paſſes for a little Lobe. When it is full of Blood, it is of a dark red Colour; when the Blood is waſhed out of it, it is pale and ſoft.

Its Connection. It is faſtned in the Body by two Ligaments. The firſt, which is large and ſtrong, comes from the *Peritonæum* that covers the *Diaphragma*, and penetrating the Subſtance of the Liver, it joins the *Capſula* of the *Vena Portæ.* The ſecond is the Umbilical Vein; it comes from the Navel, and enters by the great Fiſſure of the Liver to join the *Vena Portæ*. After the Birth, it degenerates into a Ligament, but is of little Uſe for the faſtning the Liver.

Its Membrane. 'Tis covered with a common Membrane from the *Peritonæum*, beſides that every Lobe and Gland has its proper Membrane.

Its Subſtance. The common Membrane of the Liver being raiſed, its Subſtance appears to be compoſed of ſmall Glands of a Conick Figure (not eaſily to be perceived in the human Liver) and bound together by a proper Membrane into ſeveral Heaps or Lobes, which, like Bunches of Grapes, hang to the Branches of the Veſſels, from which each ſmall Gland receives a Twig, and the Lobes are tied to one another by ſmall Membranes, which fill up the Spaces between them.

Its Veſſels. The Veſſels of the Liver are, the *Vena Cava*, and the *Vena Portæ*. They are accompanied with many ſmall Branches of the Arteries, which come from the *Cæliack* and *Meſenterica Superior*. The *Vena Portæ* brings the Blood full of Bile for Secretion, and the *Cava* carries back the Blood that remains.

The *Vena Portæ* and the *Cava* enter the Liver by its concave Side, and are equally diſtributed through all its Subſtance: Whereever there is a Branch of the one, there is a Branch of the other; ſo that each Lobe, and each Gland in the Lobe, whether on the convex or concave Side, receive the ſame Veſſels. The *Vena Portæ*, performing the Office of an Artery, brings the Blood full of Bile; which being ſtrained off by the Glands, the reſt of the Blood is carried back by the Branches of the *Vena Cava* to the Heart.

It receives its Nerves from the *Plexus Hepaticus* of the Intercoſtal Nerve.

Beſides theſe Veſſels, the Liver has Lymphatick Veſſels, moſt of which open into the Conglobate Glands, near the *Vena Portæ*, on the concave Side of the Liver; from thence the *Lympha* is carried by other Lymphaticks to the *Receptaculum Chyli*.

The Excretory Veſſels of the Liver. *Of the Gall-Bladder.* We come now to the Excretory Veſſels of the Liver, which are, the *Veſicula Fellis*, and *Porus Bilarius*. The *Veſicula Fellis*, or Gall-Bladder, is fixed to the concave Side of the Liver, into which its back Part makes a ſmall Dent. Its Figure is like that of a Pear; it is of a different Bigneſs almoſt in every Subject; the biggeſt is about the Bigneſs of a little Hen-Egg. When the Liver is in its natural Situation, the Bottom or largeſt Part of the Bladder is downwards, and the Neck or narroweſt Part upwards; and then it touches the Stomach as well as the *Colon*, where it frequently dyes them yellow. This Bladder is compoſed of three Coats: The outermoſt is common to it with the Liver; the next which is proper to it, is thick and ſolid, compoſed of tranſverſe, oblique, and ſtraight Fibres; the third is thin and nervous. This laſt Coat is covered within by a kind of Cruſt or Mucus, which preſerves it againſt the Acrimony of the Bile, ſecerned probably by ſome ſmall Glands, which *Malpighius* has remarked, between its Coats, where the Cyſtick Arteries end; which gave him Ground to think that it was the ſame in the *Porus Bilarius*.

Bilarius. The Bile is brought into the Gall-Bladder by ſome ſmall Veſſels which ariſe from the neighbouring *Glands*, and uniting, form one or two Pipes which open at the Neck of the Bladder. Theſe Ducts I could never diſcover in any Liver but an Ox's, though I have Reaſon to think that they are likewiſe in a human.

From the Neck of the Gall-Bladder there goes a Pipe, not in a ſtraight Line with a Bladder, but, as it were, more depreſſed in the Liver: It is called *Ductus Cyſticus.* Some ſmall Biliary Ducts open likewiſe into it, and its inner Membrane has ſeveral *Rugæ*, which retard the Motion of the Bile. To this Pipe, which is about the Bigneſs of a Gooſe-quill, is joined another called *Ductus Hepaticus*, or *Porus Bilarius.* Theſe two together make the *Ductus Communis Choledochus*, which goes obliquely to the lower End of the *Duodenum*, or Beginning of the *Jejunum*. After it has pierced the firſt Coat, it runs near two Fingers Breadth between the Coats, before it opens in the Cavity of the Inteſtine; which oblique Inſertion ſerves inſtead of a Valve to hinder the Bile to return into the *Ductus Communis*, having once entered the Inteſtine.

Of the Ductus Cyſticus.

Ductus Hepaticus.

The Gall-Bladder has two Veins from the *Vena Portæ*, which are called *Cyſticæ Gemellæ.* It has ſome ſmall Arteries from the *Cœliaca Dextra*, and ſome Lymphaticks.

Of the Porus Bilarius.

The *Porus Bilarius* is another excretory Veſſel of the Liver. It has as many Branches as the *Vena Portæ*, which it accompanies through every Lobe and Gland in the Liver.

Wherever there is a Branch of the one, there is a Branch of the other; and theſe two are encloſed in one common Capſule, as in a Sheath: The Uſe of this Capſule is to facilitate the Motion of the Blood and Bile, by the Contraction of its Fibres. All theſe Branches unite, and make one Trunk, of the Bigneſs of a ſmall Quill, which joins (as we have ſaid) the End of the *Ductus Cyſticus*, for the carrying the Bile from the Liver to the Inteſtines, by the *Ductus Communis Choledochus*.

The Inſertion of the *Porus Bilarius* into the *Ductus Cyſticus*, is oblique, with its Mouth looking towards the *Ductus Communis*; by which Means it is impoſſible that the Bile which comes from the *Cyſtis* can enter the *Porus*, unleſs the *Ductus Communis* be ſtopped.

The Bile which is found in the Gall-Bladder, is thinner, and different from that which is in the *Porus Bilarius*. This *Malpighius* proves by an Experiment, which is, that having tied the *Ductus Cyſticus*, he remarked, that the Bile which came by the *Porus Bilarius*, was of a different Taſte, Smell, Colour, and Conſiſtency, from that in the Gall-Bladder.

The Uſe of the Bile.

The Uſe of the Bile is to ſheath or blunt the Acids of the Chyle; becauſe they being entangled with its Sulphurs, thicken it ſo as that it cannot be ſufficiently diluted by the *Succus Pancreaticus* to enter the Lacteal Veſſels. This appears not only from the Analyſis of the Bile, which yields more of a lixivious than of a volatile alcaline Salt: But likewiſe from what *Leuwenhoeck* has obſerved, that of the great Quantity of acid Salts he has ſeen amongſt the Aliments in the Stomach, he never could find any in the Chyle, after it had paſſed the *Duodenum*.

Becauſe ſome Chyle is almoſt always paſſing through the *Duodenum*, therefore it was neceſſary that the Bile likewiſe ſhould be continually poured into it from the *Ductus Hepaticus*. In a Dog, whoſe *Ductus Communis Choledochus* was near as big as a Man's, I have gathered it at the rate of two Drachms in one Hour. But becauſe a greater Quantity of Aliments requires a greater Quantity of Bile; therefore, according as the Stomach is more or leſs diſtended with Food, it preſſes out of the Gall-Bladder a proportionable Quantity of Gall to be mixed with the Chyle in the Guts.

SECT. XIII.

Of the Spleen.

Of the Situation, Connexion, and Shape of the Spleen.

THE Spleen is ſituated in the left *Hypochondrium*, under the *Diaphragma*, between the Ribs and the Stomach, above the left Kidney: It is tied to the *Peritonæum*, to the Midriff, and to the *Omentum*. It is of a bluiſh or leaden Colour, of an oblong Figure, thick at the Edges, not thin, as the Liver. It has two Membranes: The external comes from the *Peritonæum*.

Of the Internal Membrane.

The internal Membrane is finer and thinner than the external: For if you blow upon the Splenick Artery, the Air ſhall paſs through the one, but not the other. Its Fibres are not irregularly woven, as thoſe of other Membranes ſeem to be; but as they come from innumerable Points, as Rays from ſo many Centers, and the Fibres of one Point are regularly woven with the Fibres of the Points ſurrounding it. It receives Veins, Nerves, and Arteries from thoſe that enter the Spleen.

Of the Subſtance of the Spleen.

The Subſtance of the Spleen is not only kept together by its two Membranes, but alſo by innumerable Fibres which come from the Points of the internal Membrane, and are inſerted in the Points of the oppoſite Side of the ſame Membrane; the Expanſion of the Extremity of theſe Fibres ſeem to compoſe the internal Membrane.

The Spleen is compoſed of an Infinity of Membranes, which form little Cells and Cavities of different Figures and Bigneſs, which communicate with one another, and which are always full of Blood.

At the Extremities of the Blood-Veſſels, in the Spleen of Sheep, we find ſeveral ſmall white and ſoft Specks, which *Malpighius* calls Glands.

Arteries.

The Spleen has Arteries from the *Cæliack*, whoſe capillary Branches make frequent Inoſculations among the Membranes of the Cells. Its Veins, whoſe Extremities communicate with the Cavities of the Cells, as they come out of the Spleen, unite and make the *Ramus Splenicus* of the *Vena Portæ*, which carries the Blood from the Spleen to the Liver. Theſe, with its Nerves, which are conſiderable from the *Plexus Splenicus*, are equally diſtributed through the whole Subſtance of the Spleen, being all included in a common *Capſula*. There are likewiſe a few Lymphatick Veſſels which ariſe from the Spleen, and diſcharge them into the Lumbary Glands.

The Uſe of the Spleen.

The Spleen being always full of a dark coloured Blood, was by the Ancients thought to be the Receptacle of the *Atra Bilis*, a Humour nowhere to be found. And all that has been ſaid about its Uſe by the Moderns, has been ſo little ſatisfactory, that it has been generally acknowledged, that its Uſe was ſtill unknown. If we conſider, that the Bile, is compoſed of Particles, which ſlowly combine or unite together, and that by Reaſon of the Vicinity of the Liver to the Heart, and of the ſwift Motion of the Blood through the *Aorta*, theſe Particles could not in ſo ſmall a Time, and with ſo great a Velocity, have been united together, had not the Blood been brought through the Coats of the Stomach, Inteſtines, and *Omentum*, by the Branches of the *Vena Portæ*, to the Liver. But becauſe all theſe Parts were not ſufficient to receive all the Blood which was neceſſary to be ſent to the Liver; therefore Nature framed the Spleen, into whoſe Cavities the Blood being poured from a ſmall Artery, moves at leaſt as ſlowly as any that paſſes otherwiſe to the Liver; by which means the Particles which compoſe the Bile in the Blood which paſſes through the *Ramus Splenicus*, by ſo long and ſlow a Circulation, have more Chances for uniting them, which otherwiſe they would not have had, had they been carried by the Branches of the Celiac Artery directly to the Liver; and conſequently, without the Spleen, ſuch a Quantity of Bile as is now ſecerned, that is, as Nature requires, could not have been ſecerned by the Liver. And this I take to be the true Uſe of the Spleen.

SECT XIV.

Of the Kidneys, Glandulæ Renales, *Ureters and Bladder*.

Of the Number and Figure of the Kidneys.

THE Kidneys are two in Number, one on each Side; they have the ſame Figure as Kidney-Beans: Their Length is four or five Fingers Breadth; their Breadth is three, and their Thickneſs two: The right is under the Liver, and the left under the Spleen. In a *Fœtus*, their external Subſtance is divided into ſeveral Lobes joined together, which in Adults becomes more cloſe; therefore their Superficies is equal and ſmooth: They have two Membranes, the one common from the *Peritonæum*, the otherr proper; they are ordinarily covered with much Fat; their Colour is a dark red.

Of their Veſſels.

We obſerve in the Kidneys, Lymphatick Veſſels, which diſcharge themſelves into *Pequet*'s Reſervatory, Nerves which come from the Intercoſtals, Veins which go to the *Cava*; their Arteries come from the *Aorta*.

Theſe Veins and Arteries are called *Emulgents*; they pierce the Reins in their concave Sides, (which ly neareſt the *Cava* and *Aorta*) included in one Capſule, and are divided into to ſeveral Branches, which ſurround the *Pelvis.* Theſe Branches are again divided into an Infinity of other leſs, which go to the external Part of the Reins, where they inoſculate, and form a Sort of Net, from which their Extremities coming, terminate in an Infinity of little Glands.

Their Subſtance.

Theſe Glands are of a round Figure; they compoſe the outer Subſtance of the Reins, which is half a Finger thick. From each of them there goes a long ſmall Tube; theſe Tubes compoſe the inner Subſtance of the Reins. As they approach the *Pelvis* or Baſon, they gather together in little Bundles, whoſe Extremities piercing the Membrane of the *Pelvis*, form thoſe little Protuberances on the Inſide of the *Pelvis*, called *Papillæ*.

Of the Pelvis.

The *Pelvis* or Baſon is a Cavity in the Middle of the Kidneys, formed by a Dilatation of the Ureters. It ſends out ſeveral Ramifications, which divide the Urinary Tubes into Bundles, and which make a Sort of *Capſula* to the Blood-veſſels.

The Uſe of the Kidneys.

The Uſe of the Reins is to ſeparate the Urine from the Blood, which, by the Motion of the Heart and Arteries, is thruſt into the emulgent Branches which carry it to the little Glands; by which the Seroſity being ſeparated, is received by the Orifice of the little Tubes, which go from the Glands to the *Pelvis*; from thence it runs by the Ureters into the Bladder. The Blood which could not enter the Glands are brought back by the emulgent Veins.

Of the Glandulæ Renales.

In the Middle between the *Aorta* and the Kidneys, a little above the emulgent Veſſels, are ſituated the *Glandulæ Renales* or *Capſulæ Atrabilares.* They are two in Number, one on each Side, wrapt up in ſome Fat: They ſometimes change their Situation, and their Figure is alſo various; for in ſome they are round, in others ſquare, triangular, or of an irregular Figure; the right is ordinarily bigger than the left, and each about the Bigneſs of a *Nux Vomica.* In a *Fœtus*, they are always almoſt as big as the Kidneys. They are covered with a fine Membrane, and within they have ſeveral ſmall *Sinus's* which contain a blackiſh Sort of Liquor. Their Blood-Veſſels are Branches ſometimes of the *Vena Cava* and *Aorta*, and ſometimes of the Emulgents.

Their Veſſels and Uſe. The Intercoſtal Nerve furniſhes a Branch, which makes a *Plexus* upon them. Their Uſe is not yet known. Some think they ſeparate a Liquor from the Arterial Blood, for the liquoring the Blood which is too thick after it comes from the Kidneys.

Of the Ureters. The Ureters are two long and ſmall Canals which come from the Baſons of the Kidneys, one on each Side: they ly betwixt the doubling of the *Peritonæum*; and deſcending in the Form of an S, they pierce the Bladder near its Neck, where they run firſt ſome Space betwixt its Coats, and then they open to its Cavity.

Their Coats. They are compoſed of three Coats: The firſt is from the *Peritonæum:* The ſecond is made of ſome oblique muſcular Fibres: And the third, which is very ſenſible, has ſeveral ſmall Glands which ſeparate a ſlimy Liquor, to defend it againſt the Acrimony of the Urine. The neighbouring Parts furniſh them with Blood-Veſſels, and their Nerves come from the Intercoſtals, and from the *Vertebræ* of the Loins. Their Cavity is ſometimes contracted in three or four Places, eſpecially towards the Bladder. Such as are ſubject to the Gravel, and given to exceſſive Drinking, have them ſometimes ſo much dilated, that you may put the End of your little Finger into them. Their Uſe is to carry the Urine from the Reins to the Bladder. Their Obſtructions cauſes a Suppreſſion of the Urine.

Of the Bladder.

The Bladder is ſituated between the Duplicature of the *Peritonæum*, in the lower Part of the *Abdomen*, between the *Os Sacrum* and the *Os Pubis*, above the ſtraight Gut in Men, and the Neck of the Womb in Women. It is tied to the Navel by the *Urachus* degenerated into a Ligament, and its Sides to the Umbilical Arteries; its Neck to the *Inteſtinum Rectum* in Women. The human Bladder is not of the Shape of a Pear, as is commonly ſaid, being rather biggeſt near its Neck; the Urine preſſing moſtly there, by Reaſon of our erect Station. It is compoſed of three Coats: The firſt is a Covering of the *Peritonæum*. The ſecond is compoſed of muſcular Fibres, which run irregularly ſeveral Ways. And the third, which is full of Wrinkles for facilitating its Dilatation, is both Glandulous, and Nervous. Its Glands ſeparate a viſcous and ſlimy Matter, which defends it from the Acrimony of the Salts in the Urine. Around its Neck (which is longer in Men than in Women) there goes a ſmall Muſcle called *Sphincter Veſicæ*, which contracts the Orifice of the Bladder, that the Urine may not run out, but when it thruſts open the Paſſage, by the Contraction of the ſecond Coat of the Bladder, which is therefore called *Detruſor Urinæ*. The Blood-Veſſels of the Bladder are Branches of the Hypogaſtricks: Its Nerves come from the Intercoſtals. Its Uſe is, to be a Reſervatory of the Urine, that it may not inceſſantly run from us, as it is ſeparated in the Kidneys.

We find in the Urine much Phlegm and Volatile Salt, a little Sulphur, Earth, and fixed Salt.

SECT. XV.

Of the Parts of Generation proper to Men.

THE Parts of Generation proper to Men may be fitly divided into thoſe which prepare and ſeparate the Seed from the Blood, and thoſe which convey it into the Womb. The firſt is done by three Sorts of Glands, which are the *Teſtes*, the *Veſiculæ Seminales*, and the *Proſtratæ*. The ſecond is the Office of the *Penis*, or Yard.

The *Teſtes*, which prepare the principal Part of the Seed, receive their Blood from two long and ſlender Arteries, which, at their Riſe from the Sides of the *Aorta*, a little below the Emulgents, are Extremely ſmall, but immediately become bigger; the Reaſon of which Mechaniſm we have already explained in ſpeaking of Secretion. As theſe

Arteries run between the Duplicature of the *Peritonæum,* to which they give ſome ſmall Twigs, they paſs out of the *Abdomen* at the Holes in the tranſverſe and oblique Muſcles, and march over the *Os Pubis,* within the Productions of the *Peritonæum,* to the Teſticles; but, before they arrive, they divide each into two Branches, the largeſt of which are ſpent upon the Teſticles themſelves, and the two ſmall ones upon the *Epididymides.* When the Blood has diſcharged itſelf of the Seed into the Teſticles, it returns by the Veins, which riſing in ſeveral Branches from the *Teſtes,* tend towards the *Abdomen,* in the Productions of the *Peritonæum,* the ſame way the *Arteries* came down. In their Progreſs, their Branches frequently inoſculate, and divide again, till they come near the *Abdomen,* then they all unite in one Trunk; and therefore, becauſe of their Shape, are called *Corpora Pyramidalia.* In the *Abdomen* they receive ſome ſmall Twigs from the *Peritonæum.* The right Spermatick Vein opens into the *Vena Cava,* a little below the Emulgent: But the left is always inſerted into the Emulgent of the ſame Side, that it may not be obliged to croſs the *Aorta,* whoſe Pulſe would be apt to ſtop the Blood which returns from the Teſticles very ſlowly, by reaſon of the narrow Orifices of the Spermatick Arteries, and the Largeneſs of the Veins. Theſe Blood-Veſſels have been called the *Vaſa Præparantia.*

The Vaſa Præparantia.

Having deſcribed the Blood-Veſſels of the *Teſticles,* I come now to their Integuments, which are three, one common, and two proper.

Of the Scrotum. per. The common is the *Scrotum*, which beſides the Skin (which is very thin, and full of Blood-Veſſels) Scarf-ſkin and *Membrana Adipoſa*, in this Place likewiſe very thin, its Veſicles being empty of Fat; is compoſed likewiſe of many fleſhy or muſcular Fibres, by means of which the *Scrotum* is contracted, which is reckoned a Sign of Health. This muſcular Lining of the *Scrotum*, is by the *Greeks* called *Dartos*. The *Scrotum* is divided in the Middle by a thin Membrane, which ſeparates the two *Teſticles*.

The Tunica Vaginalis. The firſt of the proper Integuments is called *Tunica Vaginalis*, or Ἐλυθροειδὴς, being formed by the Dilatation of the Productions of the external Membrane of the *Peritonæum*; its internal Superfices is ſmooth, its external rough: It contains the *Vaſa Præparantia* and *Deferentia*; it embraces looſely the whole Body of the *Teſticle*, adhering to one End of the *Epididymis*. Upon the outſide of this Tunicle runs a Muſcle called *Cremaſter*, from its Office; it riſes from the *Os Pubis*, and ſpreading its Fibres upon the *Elythroides*, it ſuſpends the *Teſticles*, and draws them up in the Act of Generation.

Of the Albuginea. The ſecond is that which covers immediately the *Teſticles*. It is called *Albuginea*, becauſe of its white Colour. It is ſtrong and thick, very ſmooth and equal. The Branches of the *Vaſa Præparantia* are finely waved upon it.

Of the Subſtance of the Teſticles. The Subſtance of the Teſticles, which formerly was thought to be a ſort of Marrow, is nothing but the folding of ſeveral ſmall and ſoft Tubes, diſpoſed in ſuch a Manner, that if they could be ſeparated from one another, without breaking them, they might be drawn out to a great Length. They run in ſhort Waves from the *Tunica Albuginea* to the *Axis* of the *Teſticles*, being divided from one another by thin Membranous Productions from the inner Side of the *Albuginea*. Theſe Productions unite at the *Axis* of the *Teſticle*, and form a Cover to ſome ſmall Tubes which at one End of the *Teſticle* pierce the *Tunica Albuginea*, and unite into one Canal, which, by ſeveral Turnings and Windings upon the upper Part of the *Teſticles*, forms that Body which we call *Epididymis*, covered with a thin Production of the *Albuginea*. The ſame Canal continuing and aſcending from the Extremities of the *Epididymis*, forms the *Vaſa Deferentia*, one from each *Epididymis*, about the Bigneſs of a Gooſe-quill: As they aſcend within the *Tunica Vaginalis*, they make ſeveral ſhort Turnings and Windings; then they enter by the Holes of the tranſverſe and oblique Muſcles into the *Abdomen*, and marching over the Ureters between the back Side of the Bladder and the *Rectum*, they grow larger as they approach the *Veſiculæ Seminales*, (which open into them) where they come cloſe to one another, and growing again ſmaller and ſmaller, they paſs through the *Proſtatæ*, and open into the *Urethra*, a little below the Neck of the Bladder, where each Orifice has a ſpongeous Border, called *Caput Gallinaginis*, which hinders the involuntary running of the Seed. The Cavity of the *Vaſa Deferentia*, before they enter the *Abdomen*, will hardly admit of a

Of the Epididymis.

Of the Vaſa Deferentia.

Hog's Briſtle; as they increaſe, ſo likewiſe do their Cavities, which are tortuous and obliquely contracted by their inner Coat, which is nervous, whiter and thinner than the external, which is compoſed of muſcular Fibres. The *Teſticles* have many Lympheducts, which diſcharge themſelves into the inguinal Glands. Their Nerves come from the Intercoſtal, and 21ſt of the Spine.

The Spermatic Arteries carry the Blood from the *Aorta* to the *Teſticles*, which ſeparate that Part of it which is fit for Seed. The Veins carry back to the *Cava* what Blood remains, after the Secretion of the Seed. The Seed is farther purified in the *Epididymides*, and in Coition is carried by the *Vaſa Deferentia* into the *Urethra*. As the narrow Orifices, and great Length of the Spermatic Arteries (which give Time to the ſlow moving Particles of the viſcous Seed to combine and unite) are a clear Proof of what we have ſaid concerning the Formation of the Humours to be ſecerned; ſo the Length of the Tubes, which compoſe the Body of the Teſticles, does not leſs evidently evince the Structure we have given of a Gland: For the Particles which compoſe the Seed being groſs, all the ſmaller Particles of the Blood muſt enter the Tubes with them; and therefore, that none but the Particles of the Seed might arrive at the *Vas Deferens*, it was neceſſary that the Tube of the Gland ſhould be long, having many ſmaller Branches, to convey off all the leſſer Particles, which were not to enter into the Compoſition of the Seed. Many of theſe Particles muſt be lymphatick, becauſe of the great Proportion they bear in the Blood; and therefore we find that the Teſticles, as well as the Liver, have a Multitude of lymphatick Veſſels. The Reaſon of the Length of the *Vaſa Deferentia* is, that the *Impetus* of the Seed at the *Caput Gallinaginis* might not be ſufficient to dilate the Orifices of the *Vaſa Deferentia*, but when aſſiſted with the Compreſſion of the ſurrounding Parts in Copulation.

Of the Veſiculæ Seminales.

The *Veſiculæ Seminales* are two in Number, one on each Side, ſituated betwixt the Bladder and the ſtraight Gut, tied to the one and the other by a Membrane of the fleſhy Fibres, which in Time of Coition contracts and preſſes the *Veſiculæ*: They are covered with a pretty thin Membrane, upon which do creep many Branches of Veins, Arteries, Nerves and Lymphaticks. Their external Surface reſembles rather that of the Brains, than that of the Guts of a little Bird; they are about two Fingers Breadth long; their broadeſt Part is not an Inch, from which they grow narrower by little and little to their End, which is next the *Proſtatæ*. They have two conſiderable Cavities divided into membranous Cells, which open diſtinctly by two Orifices, which are in their ſmall Extremities, into the two *Vaſa Deferentia*, from which they receive the Seed which is ſeparated in the *Teſticles* to be kept till Coition.

Of the Proſtatæ.

The *Proſtatæ*, or *Corpus Glanduloſum*, is a Conglomerate Gland ſituated at the Neck of the Bladder, covered with a Membrane made of muſcular Fibres, as that of the *Veſiculæ*, and for the ſame Uſe. It is about the Bigneſs of a Walnut. The *Vaſa Deferentia* paſs through its Subſtance, which is veſicular and glandulous. The Glands (which like little Grains ly upon the Sides of the Veſicles) ſeparate a clear and mucilaginous Humour, which lies in the Veſicles till Coition, when it is carried into the Beginning of the *Urethra* by eleven or twelve Excretory Ducts, which open about the Orifices of the *Vaſa Deferentia*; the Border of their Mouth is all ſpongeous, to hinder a continual running of this Humour, which happens in a *Gonorrhœa*, when their Orifices are corroded by the morbifick Matter, which is thruſt, by the Elaſticity of the Air, into the empty Ducts upon Coition.

Of the Yard. The other principal Member of the Parts of Generation, is the *Penis* or Yard, whoſe Shape and Dimenſions are pretty well known. Its Skin, which is thin, and without Fat, has a Reduplication, which makes a Hood to the *Glans*, or End of the Yard, called *Preputium*, or the Fore-ſkin. The ſmall Ligament, by which it is tied to the under Side of the *Glans*, is called *Frænum*. The Uſe of the *Præputium* is to keep the *Glans* ſoft and moiſt, that it may have an exquiſite Senſe.

The Subſtance of the Yard is compoſed of two ſpongeous Bodies called *Corpora Cavernoſa*; they ariſe diſtinctly from the lower Part of the *Os Pubis*. A little from their Root they come cloſe together, being only divided by a Membrane, which at its Beginning is pretty thick, but as it approaches the End of the Yard, it grows thinner and thinner, where the *Corpora Cavernoſa* terminate in the Middle of the *Glans*.

The external Subſtance of theſe ſpongy Bodies is hard, thick and white. The internal is compoſed of ſmall Fibres and Membranes which form a Sort of looſe Net-work, upon which the Branches of the Blood-Veſſels are curiouſly ſpread. When the Blood is ſtopt in the great Veins of the *Penis*, it runs through ſeveral ſmall Holes in the Sides of their Capillary Branches into the Cavities of the Net-work, by which Means the *Corpora Cavernoſa* become diſtended, or the *Penis* erected.

Of the Urethra.

Along the under Side of the *Corpora Cavernoſa*, there runs a Pipe called the *Urethra*, which is about twelve or thirteen Inches long, beginning at the Neck of the Bladder (from which it receives the Urine) it bends to the lower Part of the *Os Pubis*, and turning up to the Roots of the *Corpora Cavernoſa*, is continued to the End of the Yard. The Sides of this Pipe are compoſed of two Membranes, and a middle ſpongy Subſtance, like that of the *Corpora Cavernoſa*, except at the End, which joins the Neck of the Bladder; where the Diſtance between the Membranes is ſmall, and filled up with a thin and red glandulous Subſtance, whoſe excretory Ducts piercing the inner Membrane, pour into the Pipe a mucilaginous Liquor. The external Membrane is hard, cloſe and white; the internal, which lines the Cavity of the *Urethra*, is thin, ſoft, and of an exquiſite Senſe. The ſpongeous Subſtance which lies between the two Membranes, is about half a Line thick next to the *Corpora Cavernoſa*, one half Line round the reſt of the Pipe. The Extremities of this ſpongy Subſtance are much thicker than in the Middle: That End next the *Proſtatæ*, becauſe of its Bigneſs, is called the Bulb of the *Urethra*, being about half an Inch thick, and divided into the Middle by a thin Partition, as the *Corpora Cavernoſa* are. The other End forms the *Glans* or *Balanus* upon the Extremities of the *Corpora Cavernoſa*. The *Veins* in the *Urethra* have Holes in their Sides, through which the Blood paſſes into the Cavities of its Net-work, in an Erection, as in the *Corpora Cavernoſa*.

On each Side of the Bulb of the *Urethra* there lies a ſmall Gland, whoſe excretory Duct ſloping forwards, pours into the *Urethra* a viſcuous and tranſparent Liquor, which defends it againſt the Acrimony of the Salts of the Urine. And on the oppoſite Side of the *Urethra*, upon its internal Membrane, a little nearer the *Glans*, there is another ſmall *Gland* which has the ſame Office. Theſe *Glands* were firſt obſerved by that diligent Anatomiſt, Mr. *Cowper*. At the other End of the *Urethra*, around the Crown of the *Glans* where it joins the *Præputium*, is a Row of ſmall Glands, like unto thoſe of the *Cilia*, called by that accurate Anatomiſt, Dr. *Tyſon*, *Glandulæ Odoriferæ*: They ſeparate a Liquor, which lubricates the *Glans*, that the *Præputium* may ſlip eaſily upon it.

Of the Veſſels of the Yard. The Yard has a ſmall Ligament which ariſes from its Back, a little Diſtance from its Root, which ties it to the upper Part of the *Os Pubis*, that it may not hang too low. It receives two Branches of *Veins* and *Arteries* from the Hypogaſtrick Veſſels; beſides the others from the *Pudenda*. The two *Veins* unite near its Roots, and form one Trunk that runs along the upper Side of the Yard. It has two *Nerves* from the *Os Sacrum*, and ſeveral Lymphaticks, which empty themſelves into the inguinal *Glands*.

Of its Muſcles and Erection.

The Yard has three Pair of Muſcles. The firſt is the *Erectores*; they riſe from the *Iſchium*, a little below the Roots of the *Corpora Cavernoſa*; they ly upon them, and are inſerted into them. The ſecond are the *Acceleratores*; they riſe from the Root of the *Urethra*; they have ſeveral *Fibres*, which join the *Fibres* of the *Sphincter Ani*; they ly upon the *Urethra*, betwixt the two former, and are inſerted into the *Corpora Cavernoſa*. The third Pair are the *Tranſverſales*; they ariſe from the *Iſchium* juſt by the *Erectores*, and run obliquely to the upper Part of the Bulb of the *Urethra*. When theſe *Muſcles* act, they preſs the Veins upon the Back of the *Penis* againſt the *Os Pubis*, which is the Cauſe of the Erection, as has been ſaid.

SECT. XVI.

Of the Parts of Generation proper to Women.

HAving in the firſt Chapter deſcribed the Figure and Situation of the external Parts of Generation proper to Women; I ſhall here only examine their Subſtance and Uſe, and then proceed to the internal Parts.

Of the Clitoris.

The *Clitoris*, which is in the Fore-part of the *Vulva*, is a long and round Body, naturally about the Bigneſs of the *Uvula*: It lies within the Skin; nor does any Part of it appear outwardly, except its Extremity, which is covered with a Folding of the Skin, made by the Union of the *Nymphæ*, called its *Præputium*. The Subſtance of the *Clitoris* is compoſed of two ſpongeous Bodies, ſuch as thoſe of the Yard: they riſe diſtinctly from the lower Part of the *Os Pubis*, and approaching one another, they unite and form the Body of the *Clitoris*, whoſe Extremity, which is of an exquiſite Senſe, is called its *Glans*. The two ſpongeous Bodies, before they unite, are called the *Crura Clitoridis*, they are twice as long as the Body of the *Clitoris*. It has two *Muſcles*, which riſe from the Protuberance of the *Iſchium*, and are inſerted in its ſpongeous Bodies. They erect the *Clitoris* in Coition, after the ſame Manner that the Muſcles of the Yard do erect the Yard.

Its Muſcles.

Its Veſſels.

The *Clitoris* receives *Veins* and *Arteries* from the Hæmorrhoidal Veſſels and the *Pudenda*, Nerves, from the Intercoſtals, which are likewiſe diſtributed through all the Parts of the *Vulva*. Remark, that the Veins on the one Side of the *Vulva* communicate with thoſe of the other Side, and ſo do the *Arteries* communicate with one another.

Of the Nymphæ.

The *Nymphæ* have been ſufficiently deſcribed already. Their internal Subſtance is ſpongeous, and full of Blood-Veſſels, therefore they ſwell in the Act of Copulation; they receive Veſſels and Nerves as the *Clitoris*; their Uſe is to defend the internal Parts from external Injuries, to increaſe Pleaſure in Coition, to direct the Courſe of the Urine: They are bigger in married Women than in Maids.

The *Hymen* is a circular Folding of the inner Membrane of the *Vagina;* which being broke at the firſt Copulation, its Fibres contract in three or four Places, and form what they call *Glandulæ Myrtiformes.*

Urethra. A little beyond the *Clitoris,* in the fore Part of the *Vulva,* above the Neck of the Womb, there is a little Hole, which is the Orifice of the *Urethra:* It is naturally ſo large as to receive a Probe as big as a Gooſe-quill. The Length of the Neck of the Bladder is near about two Fingers Breadth. It has a little Muſcle called its *Sphincter,* which embraces the *Urethra,* to hinder the involuntary running of the Urine; it joins the fleſhy Fibres which are at the Orifice of the *Vagina.*

Lacunæ. Between this Muſcle and the inner Membrane of the *Vagina* there are ſeveral little *Glands,* whoſe excretory Ducts are called *Lacunæ:* They pour a viſcous Liquor, for the tickling of the Sex, into the lower Part of the *Vulva.* Theſe Glands are the Seat of the *Gonorrhœas* in Women, as the *Proſtatæ* are in Men; and have the ſame Uſe that they have. They have been found all ulcerate in Women which have had a *Gonorrhœa.*

Vagina. The *Vagina,* or Neck of the Womb, is a long and round Canal, which reaches from the *Pudendum* to the internal Mouth of the Womb. In Maids it is about five Fingers Breadth long, and one and a half wide; but in Women who have born Children, its Length and Bigneſs cannot be determined, becauſe it lengthens in the Time a Woman is with Child, and it dilates in the Time of Birth. It lies betwixt the Bladder and the *Rectum*, with which laſt it is wrapt up in the ſame common Membrane from the *Peritonæum;* for this Reaſon the Excrements come out ſometimes by the *Vulva*, when this Inteſtine is wounded.

The Subſtance of the *Vagina* is compoſed of two Membranes, of which the inner, which lines its Cavity, is nervous, and full of Wrinkles and *Sulci*, eſpecially in its fore Part. It has three or four ſmall Glands on that Side next the *Rectum*, which pour into it a viſcous Humour, in the Time of Coition, of which we have ſpoken before.

The Wrinkles of this Membrane are for the Friction of the *Balanus*, to increaſe the Pleaſure in Copulation, to detain the Seed that it may not run out again, and that it may extend in the Time of Geſtation.

The external Membrane of the *Vagina* is made of muſcular Fibres, (which as Occaſion requires) dilate and contract, become long and ſhort, for adjuſting its Cavity to the Length and Bigneſs of the Yard. At its lower Part there is a Muſcle of circular Fibres like a Sphincter, and under it, on each Side of the *Vagina*, a Net-like *Plexus* of Blood-veſſels, which, with the Muſcle, helps to ſtraiten the Mouth of the *Vagina*, that it may graſp the Yard cloſly.

The Neck of the Womb receives Veins and Arteries from the Hypogaſtrick and the Hæmorrhoidal Veſſels. Thoſe from the Hypogaſtrick are diſperſed in its upper Part, and thoſe from the Hæmorrhoidal in its lower Part. Theſe Veſſels communicate with one another. It has Nerves from the *Os Sacrum.* Among other Uſes, the Neck of the *Matrix* ſerves for a Conduit to the *Menſtrua,* and for a Paſſage to the *Fœtus.*

Of the Situation of the Matrix.

The *Matrix* or Womb is ſituated in the lower Part of the *Hypogaſtrium,* betwixt the Bladder and the ſtrait Gut; the *Os Pubis* is a Fence to it before, the *Sacrum* behind, and the *Ilium* on each Side; theſe form as it were a Baſon for it; but becauſe it muſt ſwell whilſt Women are with Child, therefore they leave a greater Space in them than Men; it is for this Reaſon that Women are bigger in the Haunches than Men.

Of its Figure.

The Figure of the Womb is like a Pear, from its internal Orifice to its Bottom; it is three Fingers long, two broad, and almoſt as much thick. In Maids its Cavity will contain a big Almond: It changes both Figure and Dimenſions in Women that are with Child; it preſſes the Bowels, and reaches to the Navel towards their Delivery, whilſt at other Times it does not paſs the *Os Sacrum.*

Of its Subſtance.

The Womb is covered with the *Peritonæum.* Its Subſtance is compoſed of fleſhy Fibres, which are woven together like a Net, and they draw together and make ſeveral Bundles, which have ſeveral Directions for the better contracting of the Womb in the Expulſion of the *Fœtus.* The Spaces between theſe Fibres are filled up with thin and ſoft Membranes, which form an infinite Number of Cells, upon which the Blood-veſſels run; turning and winding frequently.

Upon theſe Membranes, eſpecially towards the Cavity of the Womb, there are ſeveral Glands which ſeparate an Humour to lubricate the Cavity of the Womb.

The Bottom of the Womb grows thick, as it dilates; ſo that in the laſt Month of Geſtation, it is at leaſt an Inch thick, where the *Placenta* adheres, becauſe its Roots run into the Subſtance of the Womb.

The Entry into the Cavity, or the Mouth of the Womb, joins the upper End of the *Vagina*, and makes a little Protuberance in the Form of Lips, and reſembles the Muzzle of a little Dog, by ſome called *Os Tincæ*. The Cavity of the Womb next its internal Orifice being more contracted than it is near to its Bottom, is called *Collum minus Uteri*. Its Surface is unequal, and, among its *Rugæ*, open ſeveral ſmall Ducts, which diſcharge a glutinous Liquor to ſeal up the Mouth of the Womb in Geſtation. The Ducts are affected in a *Fluor Albus*.

Of its Veſſels. The Veins and Arteries of the Womb are Branches of the *Hypogaſtrick* and *Spermatick* Veſſels, whoſe larger Ramifications inoſculate with one another; the ſpermatick Artery with the hypogaſtrick, and the Vein with the Vein, as alſo the Branches of one Side of the Womb with thoſe of the other. When the Term of Accretion draws to a Period, and the Blood which was wont to be ſpent in the Increaſe of the Body, being accumulated, diſtends the Veſſels, it breaks forth once a Month, at thoſe of the Womb; becauſe of all the Veins in the Body, which ſtand perpendicular to the Horizon, theſe only are without Valves. This Evacuation is called the *Menſtrua*, to which Men for the ſame Reaſon are ſubject, but in them the redundant Humour paſſes off by Urine, as *Sanctorius* obſerves, and rarely by the hæmorrhoidal Veins.

Its Nerves come from the Intercoſtals, and from thoſe which come from the *Os Sacrum*. There are alſo ſeveral Lymphaticks upon its Outſide, which unite by little and little into greater Branches, and diſcharge themſelves in the Reſervatory of the Chyle. All the Veſſels of the Womb creep upon it by many Turnings and Windings, that they may not break when it is diſtended.

Of its Ligaments.

The Womb is tied by two Sorts of Ligaments; by two broad, called *Ligamenta Lata*; and by two round, called *Ligamenta Rotunda*. The two broad Ligaments are only a Production or Continuation of the *Peritonæum* from the Sides of the Womb. For their Largeneſs and Figure, they are commonly compared to the Wings of a Bat. The *Ovaria* are faſtned to one End of them, and the *Tubæ Fallopianæ* run along the other.

The two round Ligaments riſe from the fore and lateral Part of the Bottom of the Womb, and paſs, in the Productions of the *Peritonæum*, through the Rings of the oblique and tranſverſe Muſcles of the *Abdomen* to the *Os Pubis*, where they expand like a Gooſe-foot, and are partly inſerted in the *Os Pubis*, and partly continued or joined to the *Muſculus Membranoſus*, or *Faſcia Lata*, on the upper Part of the Inſide of the Thigh; from thence comes the Pain that Women, big with Child, feel in this Place. The Subſtance of theſe Ligaments is hard, but covered with a great Number of Blood-veſſels; they are pretty big at the Bottom of the Womb, but they grow ſmaller and flatter as they approach the *Os Pubis.*

Of the Spermatick Veſſels.

The Spermatick Veſſels in Women are four, as in Men; they differ only in this, that they are ſhorter, and the Artery makes ſeveral Turnings and Windings as it goes down, that it divides into two Branches, of which the ſmalleſt goes to the *Ovarium;* the biggeſt divides into three more, of which one is beſtowed upon the Womb, another upon the *Vagina,* and the third upon the Ligaments of the Womb and *Tubæ Fallopianæ:* It is the ſame as to the Vein.

Of the Situation and Figure of the Ovaria.

The *Ovaria* are tied about two Fingers Diſtance from the Bottom of the Womb by the *Ligamenta Lata.* They are fixed to the *Peritonæum* at the *Ilia* by the Spermatick Veſſels. They are of an oval Figure, a little flat upon their upper Part, where the Spermatick Veſſels enter.

Of their Membranes and Subſtance.

The *Ovaria* or Teſticles are near half as big as Mens are; their Surface is unequal and wrinkled in old Women, but ſmooth and equal in Maids; they are covered with a proper Membrane, which ſticks cloſe to their Subſtance, and with another common from the *Peritonæum,* which covers all the Spermatick Veſſels. Their Subſtance is compoſed of Fibres and Membranes, which leave little Spaces, in which there are ſeveral ſmall Veſicles, round, full of Water, which being boiled, hardens like the White of an Egg; they have each of them two proper Membranes, upon which there are ſeveral ſmall Twigs of Veins, Arteries, and Nerves. Theſe Veſicles are called Eggs, and they are of a different Size and Number, in Women of different Ages. We obſerve in Cows, that ſuch of them as are impregnated after Copulation, are contained or covered all over with a yellow Subſtance, which has a ſmall Hole in its Side, through which they are thruſt when they fall into the *Tubæ Fallopianæ*. Beſides the Spermatick Veſſels, the *Ovaria* have Nerves from the Intercoſtals and Lymphaticks, which diſcharge themſelves into the common Receptacle.

Of the Tubæ Fallopianæ.

The *Tubæ Fallopianæ* are ſituated on the right and left Side of the Womb; they riſe from its Bottom by a narrow Beginning, and they dilate in Form of a Trumpet to their Extremities, where they are contracted again into a ſmall Orifice, from whoſe Circumference they dilate into a pretty broad Membrane, which looks as if it were torn at its Edges, therefore called *Morſus Diaboli*. Their Cavity, where they open into the Womb, will ſcarcely admit of a Hog's Briſtle; but at its wideſt Part it will take in the End of one's little Finger. Their Subſtance is compoſed of two Membranes, which come from the external and internal Membranes of the Womb. The Tubes are about four or five Fingers Breadth long; they have the ſame Veins, Arteries, Nerves and Lymphaticks, as the *Ovaria*. Theſe are all the Parts of Generation in Women.

The Uſe of theſe Parts in Generation.

So great is the Pleaſure in the Act of Generation, that it alters the Courſe of the Blood and Animal Spirits, which then move all the above-deſcribed Parts, which before lie quiet and at reſt. The *Clitoris* is erected, which by its exquiſite Senſe affords a great deal of Delight; the Glands about the Neck of the Womb, being preſſed by the ſwelling of the neighbouring Parts, pour forth a Liquor to facilitate the Paſſage of the Yard, and to increaſe the Pleaſure. The Neck of the Womb contracts and embraces cloſly the Yard; the Fibres of the Womb contract and open its Mouth (which at other Times is extremely cloſe) for the Reception of the ſpirituous Part of the Seed; and the Branches of the Spermatick Artery which run upon the *Ligamenta Lata*, between the *Ovaria* and the *Tubæ Fallopianæ*, being diſtended with Blood, contract and pull the Extremities of the Tubes to the *Ovaria*, for carrying the Seed to them. The Seed impregnates the Egg, which, from being tranſparent, becomes opake ſome Time after; it is covered with a thick and yellow Subſtance, which preſſes it on all Sides, and thruſts it out through a little Hole in its Middle: ſo it falls into the Orifice of the Tubes, which dilate ſufficiently for its Paſſage into the Womb.

Some, partly conſidering the Cloſeneſs of the Mouth of the Womb, and partly the Thickneſs of the Membranes of the *Ovaria* and *Ova*, do judge it impoſſible for the Seed to paſs this Way; therefore they think that it is taken up by the Veins which open in the Cavity of the *Vagina* and *Matrix*, where circulating,

culating, it ferments with the Maſs of Blood: From thence come all thoſe Symptoms which appear in Conception: It enters and impregnates the Egg by the ſmall Twigs of Arteries which are upon its Membranes. This Fermentation ſwells the Membranes of the *Tubæ*, opens the Cavity of the Womb, and makes every Thing ready for the Reception of the Egg.

SECT. XVII.

Of the Generation of the Fœtus; *Of the Umbilical Veſſels; Of the* Placenta; *Of the Poſture of the* Fœtus, *and Term of Delivery.*

THE great and many Difficulties which attend the moſt plauſible Account of the firſt Formation of the Parts of an Animal, and Beginning of Motion in its Fluids; and the nice and curious Obſervations of *Redi*, *Leeuwenhoeck*, and others, have been ſufficient Motives to moſt of the Moderns to throw off the Notion of Equivocal Generation. But though both Reaſon and Experiments convince us, that all the Parts of an Animal did exiſt, and its Fluids were in Motion, before Generation; yet whether the *Animalcula* was lodged in the Seed of the Male or Female *Ova*, is Matter of Controverſy. The Arguments ſtrongly alledged on both Sides, perſuade me of the Truth of what Dr. *Garden* ſays, that the Female *Ovum* is a proper *Nidus* for the *Animalcula in Semine*. It is amazing to ſee the prodigious Number of little Creatures, like ſo many Tadpoles, ſwimming every

very Way in the Male Sperm of all Animals: Nor is it leſs curious to obſerve their languid Motion, in ſuch as are poxed, and how they recover their former Briſkneſs as the Diſtemper abates. *Leeuwenhoeck* tells us of one whoſe Wife for ſome Years did not conceive, becauſe there were no *Animalcula* to be found in his Seed, there being no other viſible Hindrance on either Side. Theſe Animals are ſo ſmall, that 3000000000 of them are not equal to a Grain of Sand, whoſe Diameter is but the hundreth Part of an Inch. Whilſt the Seed thus abounds with *Animalcula*, there are not the leaſt Rudiments of an Animal to be ſeen in any Part of the *Ovaria:* Yet theſe likewiſe have a principal Part in Generation, for without them there is no Conception; and even Bitches, which have been ſpayed, forget their uſual Appetites, as if they were the only Spurs to Venery. The yellow Subſtance which grows in the *Ovaria* of Cows, upon Conception, is very remarkable: It has a ſmall Dint, and a Cicatrice in its Middle, as if the *Ovum* had dropt out there (as *Malpighius* thinks.) When the *Fœtus* is very ſmall, I have obſerved it very large; but as the *Fœtus* grows bigger and bigger, this decays, and, I think, at laſt even vaniſhes: Nor is it to be ſeen before Conception, and in one Teſticle only, when there is but one Calf. If all the *Animalcula*, or a great many of them, did faſten and grow to the Womb, till ſuch Time as by their Bigneſs, or want of Nouriſhment, they made one another drop off, (as *Leeuwenhoeck* thinks) Women could not but be ſenſible of their Evacuation;

ation; for they muſt be falling off, through the whole Time of their being with Child. But when the *Animalcula* gets into an *Ovum* fit to receive it, and this falls through one of the *Tubæ Fallopianæ* into the Womb, the Humours which diſtil through the Veſſels of the Womb, penetrating the Coats of the Egg, ſwell and dilate it, as the Sap of Earth does Seed thrown into the Ground. Or elſe the Branches of the *Veins* and *Arteries*, whereby the Egg was tied in the *Ovarium*, (which probably make the Umbilical Veſſels) being broken, faſten with the Veſſels of the Womb; then the *Placenta* begins to appear like a little Cloud upon one Side of the external Coat of the Egg; and at the ſame Time the Spine of the *Embryo* is grown ſo big, as to be viſible; and a little after the *Cerebrum* and *Cerebellum* appear like two ſmall Bladders, and the Eyes next ſtand gogling out of the Head; then the Beating of the Heart, or *Punctum Saliens*, is plainly to be ſeen; and the Extremities diſcover themſelves laſt of all.

Now the Membranes which involve the *Fœtus* are the ſame with the Coats of the Egg. The external is called *Chorion*; it is pretty thick, and a little rough on its Outſide, to which the *Placenta* adheres. It embraces immediately the *Amnion*, or internal Membrane, which is a fine and delicate Bag full of clear Liquor, in the Middle of which the *Fœtus* ſwims. This Liquor is ſeparated, for the Nouriſhment of the *Fœtus*, by the *Glands* of the *Amnion*, from its Blood-veſſels, which are fine Branches of the Umbilical Vein and Arteries.

Of the Chorion.

Of the Amnion.

The *Arteries* riſe from the Extremity of the *Aorta,* or the Beginning of the Iliacks of the *Fœtus;* and paſſing by the Sides of the Bladder to the Navel, through which they paſs, they give ſome Branches to the *Annion* and *Chorion,* and are afterwards divided into an infinite Number of Branches in the *Placenta.* The Vein riſes by ſeveral Roots or Branches which are ſpread through all the Subſtance of the *Placenta;* it enters the *Chorion* and *Annion,* to which it gives ſeveral Twigs; and paſſing in at the Navel, it joins the *Vena Portæ,* in the Subſtance of the Liver.

The Umbilical Veſſels between the Navel and the *Placenta* are wrapt up in a Production of the *Chorion* and *Annion,* which is generally about a Foot and a half long, that the Motion of the *Fœtus* might not pull the *Placenta* from the Womb. *The Uſe of the Navel-ſtring.* The Uſe of this Navel-ſtring is to carry the Maternal Blood of the Veins to the *Fœtus,* for its Nouriſhment: That which is unfit for this Uſe, is carried back by the Arteries to the *Placenta,* whilſt the *Fœtus* is ſtill ſupplied with more by the Veins; ſo that there is a continual Circulation betwixt the Mother and the *Fœtus.*

Of the Placenta.

Now the *Placenta* is a thick Cake which grows upon the Outſide of the *Chorion,* in Proportion as the *Fœtus* grows; it is of a circular Figure, at its biggeſt it is about two Fingers Breadth thick, and ſix or ſeven in Diameter. The Branches of the Umbilical Veſſels are ſpread through all its Subſtance; and indeed, it ſeems to be nothing elſe but a Texture of the Vein and Arteries, by whoſe

Extremities opening into the Sides of the Hypogaſtrick Veſſels, the Circulation is performed between the Mother and the *Fœtus*; for that Side of the *Placenta* which adheres to the Womb, appears to be nothing but the Extremities of an infinite Number of ſmall Threads, which, in Labour, dropping out of the Pores in the Sides of the Hypogaſtrick Blood-veſſels, into which they had inſinuated themſelves, is the Occaſion of the flowing of the *Lochia*, till the *Uterus* collapſes, or the Pores, by the natural Elaſticity of the Veſſels, contract by Degrees. Sometimes Twins have only one common *Placenta*, and ſometimes they have each a diſtinct one.

Beſides theſe Membranes which involve the *Fœtus*, there is another, which lies between the *Chorion* and the *Amnion*, on the oppoſite Side to the *Placenta*, in the Form of a Bag, called the *Allantois*; it receives the Urine of the *Fœtus* from a Pipe called the *Urachus*, which riſes from the Bottom of the Bladder, and paſſes out at the Navel, to which Place its Cavity is very apparent, but hardly to be perceived afterwards in the Umbilical Rope, though there are not wanting ſome good Anatomiſts who have obſerved it even there. However, its being rarely found, has given Ground to many Anatomiſts to doubt of the Exiſtence of the human *Allantois* itſelf, the Opportunities of opening the dead Bodies of Women big with Child being very rare. Yet if we conſider, that there ſeems to be the ſame Neceſſity for the Secretion of the Urine of the human *Fœtus*, that there is for that of Brutes, and that we actually find Urine in the Bladder of the firſt, as well as of the laſt, we cannot doubt, but that Nature would provide for the one, as well as for the other. And that ſhe really has done ſo, we may gather from this, that Midwives do generally obſerve two different Sorts of Water to come away in Labour. And I have ſeen a human *Allantois* with all the Secundines curiouſly prepared by Dr. *Hale*, of which he has given a full Account in the *Philoſophical Tranſactions*.

Of the Poſture of the Fœtus.

The *Fœtus* is almoſt of an Oval Figure whilſt it lies in the Womb, for its Head hangs down with its Chin upon its Breaſt; its Back is round: With its Arms it embraces its Knees, which are drawn up to its Belly; and its Heels are cloſe to its Buttocks, its Head upwards, and its Face is towards its Mother's Belly. But, about the ninth Month, its Head, which was always ſpecifically lighter than any other Part, becomes ſpecifically heavier, its Bulk bearing a much ſmaller Proportion to its Subſtance than it did, and conſequently it muſt tumble in the Liquor which contains it; ſo its Head falls down, its Feet get up, and its Face turns towards its Mother's Back: But becauſe then it is an irkſome though favourable Poſture for its Exit, the Motion it makes for its Relief, gives frequent Pains to its Mother, which cauſes a Contraction of the Womb, for the Expulſion of the *Fœtus*. When the Child preſents in any other Poſture, it ſhould be carefully put back again, and, if poſſible, turned to the right Way; if that can't be done, it ſhould be brought out by the Feet.

CHAP. III.

Of the Thorax or middle Cavity.

SECT. I.

Of the Breaſts.

HAVING already deſcribed the Figure, Bounds, and external Parts of the *Thorax*, we come now to examine the Subſtance and Uſe of its ſeveral Parts, among which the firſt that preſents itſelf is the Breaſts.

The Subſtance of the Breaſts is compoſed of a great Number of Glands of an Oval Figure, which ly in a great Quantity of Fat. Their Excretory Ducts, as they approach the Nipple, join and unite together, till at laſt they form ſeven, eight, or more ſmall Pipes, called *Tubuli Lactiferi*, which have ſeveral croſs Canals by which they communicate with one another, that, if any one of them be ſtopt, the Milk, which was brought to it, might not ſtagnate, but paſs through by the other Pipes, which all terminate in the Extremity of the Nipple.

The Nipple is a ſpongeous Subſtance, made of two Orders of Fibres: The ſmalleſt make a fine Net-work within the larger Spaces of the Net-work of the bigger Fibres. Through it paſs the *Tubuli Lactiferi*, which grow ſmaller and ſmaller to their Extremities, that the Milk might not run out, but when the Breaſts are full, or upon Suction: It has an exquiſite Senſe, and a ſmall Erection when it is handled.

The *Arteries* and *Veins* of the Breaſts are Branches of the Subclavian and Intercoſtal. They have Nerves from the Vertebral Pairs, and from the ſixth Pair of the Brain.

The Uſe of the Breaſt is to ſeparate the Milk for the Nouriſhment of the *Fœtus*. The Tubes, which compoſe the Glands of the Breaſts in Maids, like a Sphincter Muſcle contract ſo cloſely, that no Part of the Blood can enter them: But when the Womb grows big with the *Fœtus*, and compreſſes the deſcending Trunk of the great Artery, the Blood flows in a greater Quantity, and with a greater Force through the Arteries of the Breaſts, and forces a Paſſage into their Glands, which being at firſt narrow, admits only of a thin Water; but, by growing wider by Degrees, as the Womb grows bigger, the Glands receive a thicker Serum; and after Birth they run with a thick Milk, becauſe that Blood, which before did flow to the *Fœtus*, and for three or four Days afterwards by the *Uterus*, beginning there to ſtop, does ſtill more dilate the Glands of the Breaſts.

The Breaſts in Men are very ſmall, they are chiefly for an Ornament. I have ſeen ſome Men who have had Milk in them.

SECT. II.

Of the Diaphragma, *or Midriff.*

Of the two Muſcles which compoſe the Midriff.

UNder the Breaſts ly the Muſcles and Bones which compoſe the Fore-part of the *Thorax;* theſe are deſcribed in their Places: Having therefore cut them up, and laid the Cavity of the *Thorax* open, the *Diaphragma, Pleura, Mediaſtinum,* Heart, and Lungs appear.

The *Diaphragma* is compoſed of two Muſcles, which divide the Middle from the lower Cavity. The firſt and ſuperior Muſcle ariſes from the *Sternum,* and the End of the laſt Ribs, on each Side. Its Fibres, from this ſemi-circular Origination, tend towards their Centre, and terminate in a Tendon or *Aponeuroſis,* which hath always been taken for the nervous Part of the Midriff. The ſecond and inferior Muſcle comes from the *Vertebræ* of the Loins, by two Productions, of which that on the right Side comes from the firſt, ſecond, and third *Vertebræ* of the Loins; that on the left Side is ſomewhat ſhorter; and both theſe Productions join and make the lower Part of the Midriff, which joins its Tendon with the Tendon of the other, ſo as that they make but one Membrane, or rather Partition.

The Midriff is covered with a Membrane from the *Pleura* on its upper Side, and by the *Peritonæum* on its lower Side; it is pierced in its Middle, for the Paſſage of the *Vena Cava;* and its lower Part, for the *Oeſophagus;* and the *Nerves* which go to the upper Orifice of the Stomach, and betwixt the Productions of the inferior Muſcle, paſs the *Aorta,* the Thoracick Duct, and the *Vena Azygos.*

The Midriff receives *Arteries* and *Veins* called *Phrenicæ* from the *Cava* and *Aorta;* and ſometimes on its lower Part two Branches from *Of its Veſſels.*

the *Vena Adipoſa*, and two *Arteries* from the *Lumbares*. It has two *Nerves* which come from the third *Vertebræ* of the Neck, which paſs through the Cavity of the *Thorax*, and are diſperſed in the Muſcles of the Midriff.

Of its Uſe. The Midriff, in its natural Situation is Convex on the upper Side towards the Breaſt, and Concave on its lower Side towards the Belly: Therefore, when its Fibres ſwell and contract, it muſt become plain on each Side: and conſequently the Cavity of the Breaſt is enlarged, to give Liberty to the Lungs to receive the Air in the Inſpiration: and the Stomach and Inteſtines are preſſed for the Diſtribution of the Chyle; but it diminiſhes the Cavity of the Breaſt, when it reſumes its natural Situation, and preſſes the Lungs for the Expulſion of the Air in Expiration.

SECT. III.

Of the Pleura, Mediaſtinum, *and* Thymus.

Of the Pleura. THE *Pleura* is a double Membrane which covers all the Cavity of the *Thorax*; it ariſes from the *Vertebræ* of the Back, aſcends on each Side upon the Ribs to the Middle of the *Sternum*. It is fixed to the *Perioſtæum* of the Ribs, to the internal intercoſtal *Muſcles*, and it covers the Midriff. Its Side towards the Cavity is ſmooth and equal, but that which is fixed to the Ribs is rough.

Of the Mediaſtinum. The *Mediaſtinum* is a double Membrane, formed by the Continuation of the *Pleura*, which comes from the *Sternum*, and goes ſtraight down through the Middle of the *Thorax* to the *Vertebræ*, dividing the Cavity in two. It contains, in its doubling, the Heart in its *Pericardium*; the *Vena Cava*, the *Oeſophagus*, and the Stomachick Nerves. The Membranes of the *Mediaſtinum* are finer and thinner than the *Pleura*, and they have a little Fat. The *Mediaſtinum* receives Branches of *Veins* and *Arteries* from the Mamillary and Diaphragmatick, and one Proper, called *Mediaſtina*; its *Nerves* come from the Stomachick; it has alſo ſome Lymphaticks, which open into the Thoracick Duct. The *Mediaſtinum* divides the *Thorax* into two Parts, to the end that one Lobe of the Lungs may officiate, if the other be hindred by a Wound on the other Side of the *Thorax*. Sometimes there is a Matter contained betwixt its Membranes immediately under the *Sternum*, which may occaſion the Trepaning of this Place.

Of the Thymus.

The *Thymus* is a Conglobate Gland, ſituated in the upper Part of the *Thorax*, under the *Claviculæ*, where the *Cava* and *Aorta* divide into the ſubclavian Branches. This Gland is big in Infants, but as they grow in Age, it grows leſs. Its *Arteries* and *Veins* are Branches of the *Carotides* and *Jugulars*. It has *Nerves* from the *Par Vagum*, and its Lymphatick Veſſels diſcharge themſelves in the *Ductus Thoracicus*.

The Learned Dr. *Tyſon* ſuppoſes the Uſe of this Gland to be for a *Diverticulum* to the Chyle in the Thoracick Duct of a *Fœtus*, whoſe Stomach being always full of the Liquor in which it ſwims, muſt keep the Thoracick Duct diſtended with Chyle; becauſe the Blood which the *Fœtus* receives from the Mother fills its Veins, and hinders the free Entrance of the Chyle into the Subclavian Vein. Nor can any Argument be drawn from the *Valves* in the Lympheducts of the *Thymus*, againſt this Opinion; for I have more than once injected them with Wax up to the *Thymus*, by the Thoracick Duct, as Mr. *Cowper* likewiſe obſerves.

SECT IV.

Of the Pericardium, *Heart, and its Parts.*

Of the Pericardium.

THE *Pericardium* is a thick Membrane, of a Conick Figure, it reſembles a Purſe, and contains the Heart in its Cavity. Its Baſis is pierced in five Places, for the Paſſage of the Veſſels, which enter and come out of the Heart: It lies in the Duplicature of the *Mediaſtinum*, which firmly adheres to it, as its Point does to the middle Tendon of the Midriff. It receives its Veſſels from the Mammary and *Phrenicæ*, Nerves, from the Recurrent and Diaphragmatick. It has Lymphaticks which diſcharge themſelves in the Thoracick Duct.

Of the Water contained in the Pericardium.

The Uſe of the *Pericardium* is to contain a Spoonful or two of a clear Water, which is ſeparated by ſome ſmall *Glands* in the *Pericardium*, that the Surface of the Heart may not grow dry by its continual Motion.

Of the Situation, Figure, and Connection of the Heart.

The Heart is ſituated in the Middle of the *Thorax*, between the two Lobes of the Lungs; it is of a Conick Figure, whoſe *Baſis* is the upper End, and its *Apex* or Point is the lower End, which is turned a little to the left Side, that the right Auricle may be lower than the left; by which Means the refluent Blood in the *Cava* aſcends the more eaſily; for, like other Liquors, the Blood will riſe to the ſame Height in both Legs of a reflex Tube. For the ſame Reaſon the *Aorta* runs firſt upwards, before it turns down, that the Force of the returning Blood from the lower Parts may be the greater.

The Heart is tied to the *Mediaſtinum*, to the *Pericardinum*, and ſuſtained by the great Veſſels which bring and carry back the Blood. It is covered by a Membrane which is the proper Membrane of the Muſcle; its *Baſis* is always ſurrounded with Fat. It has two *Veins*, which open into the *Cava*, immediately before it empties itſelf into the Auricle, and they are accompanied with two *Arteries* from the *Aorta*, which run through all the Subſtance of the Heart; they are called the *Coronary Veſſels*. The *Arteries* bring the Blood for the Nutrition and Motion of the Heart, and the *Veins* carry back what remains. The Branches of the *Veins* on the right Side communicate with thoſe of the left. In like manner do the *Arteries* of each Side communicate with one another; and it is the ſame, though not every where ſo evident, in all the Parts of the Body. The Heart receives a Multitude of ſmall *Nerves* from the eighth Pair, particularly they creep in great Numbers about the *Aorta*, and on the left Ventricle. It has alſo ſome Lymphaticks, which diſcharge themſelves in the Thoracick Duct.

Of its Veſſels.

At the *Baſis* of the Heart there are two

Of the Auriculæ.

Auricles, or little Ears, one on the right, the other on the left Side. In the right Ear opens the *Vena Cava*, in the left the *Vena Pulmonalis*. The firſt diſcharges the Blood that it receives from the *Cava* into the right Ventricle, and the ſecond thruſts the Blood that comes from the *Vena Pulmonalis* into the left Ventricle. The left is leſs, but thicker than the right. Their Subſtance is compoſed of two Orders of muſcular Fibres, which terminate in the Tendon in the *Baſis* of the Heart; and at the right Ear there is a Circle like to a Tendon, where the *Cava* ends. Their external Surface is ſmooth; their internal is unequal, full of ſmall fleſhy Pillars, which ſend out ſmall Fibres, that croſs and go athwart one another; and betwixt theſe Pillars there are as many Furrows; they receive *Nerves* from the Branches of the eighth Pair. They have the ſame Motions of *Syſtole* and *Diaſtole* as the Heart, which we ſhall explain afterwards. *Their Uſe.* Their Uſe is to receive the Blood which is brought by the *Vena Cava* and *Pulmonalis*, and by them to be thruſt into the Ventricles of the Heart.

Of the Ventricles of the Heart. In the Heart there are two Cavities or Ventricles, which anſwer to the two Ears, one on each Side; the Sides of theſe Cavities are very unequal, full of Fibres and little fleſhy Productions, long and round, of a different Figure and Bigneſs, called *Columnæ*, or Pillars. Betwixt theſe Fibres there are ſeveral Furrows in the Sides of the Ventricles; eſpecially in the left Ventricle, they are deeper and larger; they contribute much to the cloſe Contraction of the Ventricles. And becauſe the Side of the right Ventricle is much thinner than the left, therefore there is often a ſmall Bundle of fleſhy Fibres, which come from the middle Partition to its oppoſite Side, to hinder it from dilating too much.

The right Ventricle ſeemeth wider than the left, which is longer and narrower than the right, and its Sides ſtronger and thicker. The two Ventricles are ſeparated by the *Septum Medium*, which is properly the Inſide of the left Ventricle, being its Fibres, are continued with the Fibres of the oppoſite Side of the ſame Ventricle. The Veſſels which enter and come out of the Heart are the *Vena Cava*, the *Arteria*, and *Vena Pulmonalis*, and the *Aorta* or *Arteria Magna*.

Of the right Ventricle, and of its Valves.

The right Ventricle receives the Blood from the *Vena Cava*, through the right Ear; and at the Mouth of the Ventricle there are placed three Valves, made of a thin Membrane; they are of a triangular Figure, and are called *Tricuſpides*; their Baſes are fixed to the Mouth of the Ventricle, and their Points and Sides tied by ſmall Fibres to the fleſhy Productions. So that when the Ventricle contracts, and the oppoſite Sides approach one another, the Points of the Valves meet, and, their lateral Strings being relaxed, their Sides are likewiſe made to join one another by the Blood which gets between them and the Sides of the Ventricle; the three Valves thus united form a concave Cone, which hinders the Return of the Blood to the Auricle. It is therefore thruſt out at

Of the Valves of the Arteria Pulmonalis.

The *Arteria Pulmonalis*, which riſes immediately out of the right Ventricle: its Mouth is leſs than the *Cava;* it has three Valves, called *Sigmoidales*, or *Semilunares*, becauſe they reſemble a Half-Moon, or the *Greek* Sigma, which was writ thus, *C*. Their Subſtance is membranous. When they ſeparate they give Paſſage to the Blood, from the Ventricle into the Artery; but they ſhut the Paſſage, and are thruſt together by the Blood, if it endeavours to return. The *Arteria Pulmonalis* carries the Blood to

Of the Valves of the left Ventricle.

The *Vena Pulmonalis*, which diſcharges itſelf through the left Ear into the Ventricle of the ſame Side. At the Orifice of this Ventricle there are two Valves, called *Mitrales*, becauſe they reſemble a Mitre; they are broader than the other Valves; they are ſituated, and have the ſame Uſe as the *Tricuſpides* in the right Ventricle.

Of the Valves of the Aorta.

The *Aorta*, or great Artery, riſes immediately out of the left Ventricle; it has three Valves, which have the ſame Uſe and Figure as the *Semilunares* in the *Arteria Pulmonalis*.

Of the Subſtance of the Heart, and of the Order of its Fibres.

The Heart is a compound Muſcle; its Subſtance is made of Fibres of the ſame Nature of thoſe other Muſcles: There are ſeveral Orders of them, which have different Directions, and all their Tendons are in the Baſis of the Heart. From the *Aorta*, juſt by one of the Coronary Arteries, go out two Tendons, of which the firſt paſſes between the Pulmonary Artery, and the right Auricle, the other between the two Auricles: theſe ſurround the Entry both of the *Aorta* and left Ventricle. The Entry of the right is likewiſe tendinous, but all the Fibres which terminate about the Pulmonary Artery, terminate fleſhy.

Now of the Fibres which come from the Mouths of the right Ventricle and Pulmonary Artery, the outermoſt, which are much the fineſt, go in a ſtraight Line to the Point of the Heart. All the other which are next the Surface of the Heart, wind towards the left Hand, till they arrive at the Point, where turning underneath themſelves, and under the right Ventricle, they wind upon the left Ventricle towards the right Hand, to their Inſertion in the Baſis. Under the ſtraight Fibres, there paſs a few more, almoſt ſtraight, from the Mouth of the right Ventricle, to the Pulmonary Artery; and from the oppoſite Side of the Artery, to the ſecond Tendon of the *Aorta*, there paſs others, by both which the Mouth of the Pulmonary Artery is dilated in the Contraction of the Heart. Under all theſe, ſome, which wind from the firſt Tendon of the *Aorta*, towards the Point, when they come to the Middle of the right Ventricle, turn up again to the Root of the Pulmonary Artery, or terminate in the fleſhy Pillars and *Papillæ*. Theſe both contract the Ventricles, and dilate the Arteries at the ſame Time. The Mouths of the Ventricles are likewiſe ſurrounded with ſemi-circular Fibres, which aſſiſt the Valves in the Syſtole of the Heart; on the Side of the *Septum Medium*, which is next the right Ventricle, ſome Fibres go ſtraight from the Baſis to the *Apex*. All the reſt of the Fibres are twiſted only round the left Ventricle, and of theſe ſome creep half Way, ſome more than half Way, and then return to the Baſis by the oppoſite Side; ſome again terminate in fleſhy Pillars and *Papillæ*; the reſt turn the Point, and ſeem to me to involve the Heart more than once in their going from, and returning to the Baſis. From hence it appears, that a much greater Number of Fibres involve the left Ventricle, than do the right; being the Blood is by this thruſt only through the Lungs, but by that, through all the Parts of the Body, even to the Extremities, and back again. And that the Force of the Conſtriction of the Ventricle might be every where ſtrong, and the Texture of the Heart itſelf firmer, theſe Fibres are not at all parallel, or they do not all run with the ſame Obliquity, but the inner always decuſſate the outer, and frequently mix with one another. The Bone which is found in the Baſis of the Hearts of ſeveral Beaſts, is nothing but the Tendons of the Fibres of the Heart oſſified: It is ſometimes found in Men.

Of the Syſtole *and* Diaſtole *of the Heart.*

This Muſcle has two Motions; which they call *Syſtole* and *Diaſtole*. The *Syſtole* is when the Fibres of the Heart contract, its Sides ſwell, and it Cavities are ſtrongly preſſed on all Sides. The *Diaſtole* is when this Muſcle ceaſeth to act, its Fibres are lengthned, its Sides fall, and its Cavities become large and wide.

Of the Circulation of the Blood thro' the Heart.

Having deſcribed the Heart and its Parts, let us now conſider the Circulation of the Blood, which is performed by means of this Muſcle. The *Vena Cava Aſcendens* and *Deſcendens* unite in one, and open into the right Ear, where they unite; there is a little Protuberance made by their Coats on the Inſide of the canal like an *Iſthmus*, which directs the Blood both of the one and the other into the Ear, and ſo hinders them from ruſhing one upon another. The right Ear in its *Diaſtole* receives the Blood from the *Vena Cava*, which by its *Syſtole* is thruſt into the right Ventricle; (for the tendinous Circle, which is at the Mouth of the *Cava*, contracts and hinders the Blood to return into it) which at the ſame Time is in its *Diaſtole*. In the *Syſtole* of the right Ventricle the Blood is thruſt into the *Arteria Pulmonalis*, (for it cannot return into the Ear, becauſe of the *Valvulæ Tricuſpides*) which communicates with the *Vena Pulmonalis*, which carries back the Blood into the left Ear, which in its *Syſtole* thruſts the Blood into the left Ventricle, which is then in its *Diaſtole*. In the *Syſtole* of this Ventricle the Blood is thruſt into the *Aorta*, (for it cannot return into the Ear, becauſe of the *Valvulæ Mitrales*) which carries it through all the Body. Now the *Aorta*, when it comes out of the Heart, aſcends a little upwards, and then turns downwards to form the deſcending Trunk, for the Reaſon already given; and from the upper Side of this Turning the Cervical and Vertebral Veſſels do ariſe; by this Artifice the Blood collides againſt the Sides of the *Aorta*; its Force is broken, Part of it is taken in by the Mouths of the aſcending Branches, but its greateſt Part is directed downwards.

***Of the Circulation of the Blood in the* Fœtus.**

Let us now conſider which Way the Blood circulates in the *Fœtus*; for this you muſt obſerve, that in the right Ear, on the lower Side of the Protuberance of the *Cava*, juſt oppoſite to the Mouth of the *Cava Aſcendens*, there is a Hole called the *Foramen Ovale*, which opens into the *Vena Pulmonalis*; this Hole has a Valve, which ſuffers the Blood to enter the Vein, but hinders it to come back again. There is likewiſe a Paſſage or Canal which runs from the Trunk of the *Arteria Pulmonalis* to the Trunk of the *Aorta*.

Now the Blood which comes from the *Placenta*, by the Umbilical Vein, into the *Vena Portæ*, is ſent into the *Cava* by a Canal which goes ſtraight from the Trunk of the *Portæ* to the Trunk of the *Cava* in the Liver. This aſcends the *Vena Cava*, and is directly thrown through the *Foramen Ovale*, into the *Vena Pulmonalis*, which carries it into the left Ventricle, which throws it into the *Aorta*, to be diſtributed through all the Body. But the Blood which comes down the *Vena Cava deſcendens* is diverted by the *Iſthmus* of the *Cava*, from the *Foramen Ovale*, and falls into the right Ventricle, which thruſts it into the *Arteria Pulmonalis*, from whence Part of it is immediately carried by the communicating Canal into the *Aorta*. The Reaſon of theſe Paſſages in a *Fœtus* was, becauſe the Blood could not all paſs through the Pulmonary Blood-Veſſels, they being too much compreſſed by the Subſtance of the Lungs; but as ſoon as the Child is born, and the Preſſure is taken off from the Blood-Veſſels, by the Diſtenſion of the Lungs with Air, the Blood finding a free Paſſage through the Lungs, runs no more by the communicated ed Canal, whoſe Direction likewiſe is not now ſo favourable for its Reception as before; becauſe the Pulmonary Artery being ſtretched out with the Lungs, makes it go off at right Angles, and therefore it dries up. And now the Pulmonary Veins being diſtended with the greater Quantity of Blood which it receives from the Lungs, the Valve of the *Foramen Ovale* is preſſed cloſe to its Sides, denying a Paſſage to the Blood from the *Cava*, to be mixed with the reſt of the Blood. By this you ſee, that the Blood which comes from the *Vena Cava deſcendens*, paſſes only through the left Ventricle, whilſt the Blood which comes from the *Cava Aſcendens* paſſes only through the right Ventricle.

From what has been ſaid, it appears, that both Auricles contract at the ſame Time, as likewiſe do the Ventricles; and that, when the Auricles are contracted, the Ventricles are dilated, *& vice verſa*. To account for this alternate Motion of the Auricles and Ventricles of the Heart, we muſt conſider that the Contraction of all Muſcles is cauſed by the Influx of the Blood and Animal Spirits into the Cavities of their Fibres; and therefore whenever this ceaſeth, the Contraction of the Muſcles likewiſe ceaſeth, or, the Swelling of the Fibres abating, they may be reduced by any ſmall Force to the ſame Length they were before their Contraction, which alone is their natural State, the other being entirely cauſed by an external Force. If therefore there be an equal and continual Influx of the Blood and Animal Spirits, the Contraction of the Muſcles

will

will likewiſe be equal and continual; and, if the Influx is unequal and interrupted, the Contraction will be the ſame. What this Influx is will beſt appear from the Action of ſuch Muſcles, as have no Antagoniſt, and over which our Will has but a ſmall Influence; the moſt principal of which are the Heart and the Muſcles which dilate the Thorax in Inſpiration. Now both theſe are alternately dilated and contracted, and conſequently the Blood or Animal Spirits do not flow continually into their Fibres, but at ſmall Intervals of Time, to which theſe Contractions anſwer. That they have no Antagoniſt Muſcles, is evident to every one who is acquainted with the Structure of the Body; for the Muſcles, which, in a quick Expiration, accelerate the Motion of the Ribs downwards, are ſo weak, as to be of no Moment; and that the Preſſure of the Atmoſphere upon the Surface of our Bodies cannot ſupply the Place of Antagoniſt Muſcles, as is apparent to any one who conſiders, that the Air within us is always in *æquilibrio* with the Air without us, and conſequently the Preſſure of the Atmoſphere can neither promote nor retard the Contraction of the *Thorax*, or the Dilatation of the Heart; and there being no other Thing which can influence them, their alternate Contractions and Dilatation muſt be owing to the Influx of the Blood or Animal Spirits. There are indeed other Muſcles, which have no Antagoniſts, ſuch as the *Sphincter Gulæ, Ani* and *Veſicæ*, which we do not obſerve to be thus alternately relaxed and contracted; but the Reaſon of this is, becauſe their

Force is very weak, and conſequently their Contaction ſmall, and differing ſo little from their Relaxation, as to be imperceptible to us; and perhaps, in the ordinary Courſe of Nature, they act no other Ways than the Fibres of the Arteries do, which, when they are dilated by the Blood, by their innate Elaſticity contract again. It may perhaps be objected, that, when one Side of the Face is ſtruck with a Palſy, the other is conſtantly and inceſſantly convulſed, and that therefore the Influx of the Blood and Spirits muſt be continual. But to this I anſwer, that when the Swelling which cauſeth the Contraction of the Fibres, ſubſideth, and the Muſcles are relaxed, they will ſtill be ſhortned, till, by ſome ſmall Power, they are pulled out to their natural Length, which being here wanting, and one Contraction preſently following another, that Side of the Face will always appear as if inceſſantly convulſed. But the natural Bent of the Ribs is downwards, by which the Intercoſtal Muſcles are ſtretched out again, as well as by the weak Force of their few Antagoniſts. And when the Fibres of the Heart are relaxed, they are, by the Influx of the Blood into the Auricles and Ventricles, diſtended again till the next Contraction.

And that the Muſcles are not in a perpetual State of Contraction, will likewiſe appear from the Nature of the Cauſe of their Contraction, which without doubt is the Rarefaction of the Blood and Spirits in the Cavities of the Muſcular Fibres. Now, of whatever Nature we conceive this Rarefaction to be, it can be but temporary, and muſt quickly ceaſe in ſuch a ſmall Quantity of Fluids, as the Fibres of a Muſcle, or rather as one Veſicle of a Fibre is capable of receiving at a Time. Nor will it be of any Uſe to affirm, that there is a conſtant Supply of freſh Blood and Spirits, which keep up the Inflation of the Fibres: For this Inflation being cauſed by the Preſſure of the rarified Fluids againſt the Sides of the Fibres; whilſt this Preſſure continues, the progreſſive Motion of the Fluids thro' the Fibres muſt be at a Stop; nor can they move forward again, till the Rarefaction begins to abate, that is, till the Fibres are relaxed, and conſequently the Contraction or Action of the Muſcle muſt ceaſe, before freſh Blood can be rarified. I have inſiſted the longer upon this Point, becauſe I think it has never been ſufficiently cleared, and, if duly conſidered, it will be found of Uſe in explaining ſome Part of the Animal Oeconomy.

Being both Blood and Spirits are required for the Inflation of the Muſcles, and that we are ſure the Blood moves with a continual Stream, the Animal Spirits muſt only drop from the Nerves into the Muſcular Fibres, and there rarify the Blood after the Manner we have explained in ſpeaking of Muſcular Motion. When a Drop falls, the Fibres are preſently inflated, and the Muſcle contracted; as ſoon as the Rarefaction of the Blood is over, the Muſcle is relaxed till the next Drop falls from the Nerves, by which it is contracted again. Thus the *Syſtole* and *Diaſtole* of the Heart regularly and alternately follow

low one another; and, this being firſt clearly underſtood, it will be eaſy to give a Reaſon why the Auricles are conſtantly contracted when the Ventricles are dilated, and the Ventricles contracted when the Auricles are dilated, notwithſtanding they have all the ſame Nerves and Blood-Veſſels: For ſuppoſe all of them full of Blood before the Heart begins to beat, and that the Auricles and Ventricles are ready to contract at the ſame Time, yet, becauſe the Strength of the Ventricles is much greater than that of the Auricles, they will contract; and by their Contraction hinder that of the Auricles, which endeavour likewiſe to expel the Blood by which they are diſtended, but cannot perform it till the Relaxation of the Ventricles makes Room for its Reception. Thus their Motions neceſſarily become alternate.

In the Blood there is much Volatile Salt and Spirits, ſome Phlegm and Sulphur, a little Earth, but little or no fixed Salt. Alcalies diſſolve it, and Acids coagulate it.

SECT. V.

Of the Velocity and Quantity of the Blood.

HAving ſhewed which Way, and by what Means the Blood circulates through the Heart, we ſhall next inquire with what Velocity it moves.

The Ventricles of the Heart are each capable of receiving an Ounce of Blood, or more; and therefore, being full in their *Diaſtole,*

aſtole, we may ſuppoſe that they throw out at leaſt one Ounce of Blood each *Syſtole*. The Heart contracts about 4000 Times in an Hour, more or leſs, according to the different Temperaments, Sexes, and Ages; and therefore there paſſes through the Heart every Hour 4000 Ounces, or 250 *lib.* Weight of Blood. Now the common Opinion is, that the whole Maſs of Blood does not exceed 25 *lib.* and therefore, according to this Allowance, a Quantity of Blood equal to the whole Maſs paſſes through the Heart 10 Times in an Hour, that is, about once every ſix Minutes. If the Heart contracts 80 Times in a Minute, then 25 *lib.* Weight of Blood paſſes through its Ventricles once in five Minutes, or twelve Times in an Hour.

Now having the Number of Pulſes in any determinate Time, the Quantity of Blood thrown out at the left Ventricle of the Heart every Pulſe, and the Diameter of the *Aorta*, it will be eaſy to find with what Degree of Celerity the Blood moves through the *Aorta*: *For the Celerity with which a Fluid runs out at any Orifice, uniformly, and always running in the ſame Quantity, is equal to the Velocity of a Body, which deſcribes a Space of the ſame Length with that of a Cylinder, whoſe Baſis is equal to the Orifice, and whoſe Magnitude is equal to the Quantity of the Fluid that runs out in the ſame Time.* Now ſuppoſe the Heart contracts 80 Times in a Minute, and that each *Syſtole* throws into the *Aorta* an Ounce of Blood, which is equal in Bulk to 1,659 Inches, and conſequently 80 Ounces are 132,72 Inches. The Diameter of the *Aorta* I have found to be 0,73 Parts of an Inch, and therefore its Orifice is 0,4187, by which if 132,72 be divided, the Quotient 316 Inches, or 26 Feet, gives the Length of a Cylinder, or the Space through which the Blood moves in a Minute, ſuppoſing it were conſtantly going out of the Heart with the ſame Velocity: But becauſe of the Diaſtole of the Heart, which is at leaſt Half the Time of a Pulſation, there goes out 80 Ounces in Half a Minute; and conſequently the Velocity of the Blood is double, or it moves at the Rate of 52 Feet in a Minute.

Now, becauſe the Sum of the Sections of the Branches of an Artery is always greater than that of the Trunk, the Velocity of the Blood muſt conſtantly decreaſe as the Artery branches. The exacteſt Proportion of the Branches to their Trunks which I have lately found by meaſuring an Artery of the Thigh, injected with Wax, by that excellent Anatomiſt Mr. *Cowper*, is as 12,387 to 1000; and conſequently, from what I have elſewhere demonſtrated, the greateſt Velocity of the Blood will be to the leaſt as 5233 to 1, or the Blood moves 5233 Times ſlower in ſome Capillary Arteries than it does in the *Aorta*.

The Blood is received from the Arteries into the Veins, where it ſtill moves ſlower as it returns to the Heart again. The Arteries are to the Veins as 324 to 441, and conſequently the Blood moves in the Veins above 7116 Times ſlower than it does in the *Aorta*.

The farther the Blood moves from the Heart, the ſlower it returns; and all the Blood, which at the ſame Time is thrown out of the Heart, does not return at the ſame Time to it again, but the Times are directly as the Spaces the Blood runs over before it returns to the Heart again, and reciprocally as the Velocities; and conſequently ſome Parts of the Blood may be ſome Thouſand Times longer in returning to the Heart than others, and there is no Time when all the Blood can be ſaid to have only once circulated.

But, if there were any ſuch Time, the Quantity of the Blood in the Body muſt be firſt determined, which I do not find to be agreed upon by Authors, ſome affirming that there is but 10, others 15, 20, and 25 Pounds Weight of Blood in the whole Body. It is a very difficult Thing, if at all poſſible, to determine the juſt Quantity of Blood in any Animal Body. That bleeding to Death can never give any Eſtimate which ſhall be near to the true Quantity, is almoſt Demonſtration; for no Animal can bleed longer than the great Artery keeps full, which will be a longer or ſhorter Time, as the Artery wounded is ſmaller or greater, and the *Aorta* muſt always be the firſt Veſſel that empties.

The only Way that I know, by which we can come to a nearer Knowledge of the Quantity of the Blood, is by finding what Proportion the Cavities of the Veſſels (of which the whole Body is compoſed) bear to the Thickneſs of their Coats. This in the Veins and Arteries may be exactly found; but in the other Veſſels we only know the Quantity of Fluids they contain, by carefully evaporating

vaporating as much of their Fluids as we can. Thus I find the Fluids are to the Veſſels.

In the	Arteries,	as	1, 7	to 1.
	Veins,		15, 6	
	Muſcles,		3, 6	
	Nerves,		3,	
	Bones,		1,	

The leaſt of theſe Proportions ſhews the Liquors to be one Half of the Weight of the Body: And if we calculate upon the Proportion of the Blood in the Arteries, to their Coats, in a Body weighing 160 Pound, there will be found 100 Pounds of Blood. In this Calculation I have comprehended all the Liquors in the Body; but all of them, beſides the Blood, have been generally thought of ſo ſmall a Quantity, that the whole Body has always paſſed for ſolid, excepting the Blood: And indeed, all the Fluids in the Body are either Blood or Parts of the Blood, moved by the Force of the Heart, contained in Veſſels continued from the Arteries, and as uſeful to Life as the Blood; and therefore I think in this Inquiry not to be diſtinguiſhed from it. And whoever would make a right Judgment of the Strength of the Heart, muſt calculate the Quantity of all the Fluids moved by it; or whoever would form a right Idea of the Animal Oeconomy, muſt know the Quantity of all the uſeful Fluids, as well as of the Blood. And muſt not our Idea of it, when we conſider the Body as compoſed moſtly of Fluids, be very different from that which a Body, conſiſting moſtly of ſolid

Parts, and not above one tenth Part fluid, gives us?

SECT. VI.

Of the Lungs.

Of the Figure of the Lungs.

Of their Colour and Connection.

THE *Lungs* are in the Middle of the Cavity of the *Thorax*; they are divided into two Lobes by the *Mediaſtinum*; and the left is ordinarily ſubdivided into two more. The Figure of both *Lobes* together reſembles a Cow's Foot, being a little Concave betwixt the two Lobes, where they embrace the Heart, and behind where they ly upon the *Vertebræ*; but before, where they touch the *Sternum* and Ribs, they are convex. The Colour of the *Lungs* in a *Fœtus* is of a pale red; but, after the Air has once entered them, they loſe their red, and remain always pale; yet in *Adults* they are variegated with the one and the other. They are tied to the *Sternum* by the *Mediaſtinum* before, to the *Vertebræ* by the *Pleura* behind, where it riſes from the *Vertebræ* to the Heart by the *Vena* and *Arteria Pulmonalis*, and ſometimes to the *Pleura* where it covers the Ribs, particularly in the left Side, and eſpecially after a Pleuriſy.

Of the Membranes of the Lungs.

The *Lobes* of the *Lungs* are covered with a double Membrane; the External is a Production of the *Pleura*; the Internal not only covers immediately the Subſtance of the *Lungs*, but its inner *Lamina* fills up the Interſtices which are between the Bunches of the ſmall Lobes with little Veſicular Cells: The fine Capillary Blood-Veſſels are ſo thick upon this Membrane, that it ſeems to be nothing but a Net-work of *Veins* and *Arteries*.

Of the Structure of the Lungs.

The Subſtance of the *Lungs* is compoſed of an infinite Number of little Lobes of various Figures and Magnitudes; but their Surfaces are ſo adapted to one another as to leave but very few and ſmall Interſtices. Theſe Lobes are diſpoſed like ſo many Bunches of Grapes upon the Sides of the *Bronchi*. Each little Lobe contains within its own proper Membrane, an infinite Number of ſmall and little Orbicular Veſicles, which leave ſmall Interſtices between them, which are full of ſmall Membranes, like thoſe which tie the Lobes together. The Extremities of the Branches of the Wind-pipe open into the Cavities of the Veſicles, which are probably formed by its Membranes; but the Capillary Blood-Veſſels are only ſpread upon the Veſicles like a Net, with frequent and large Inoſculations.

Of the Veſſels of the Lungs.

Now the Veſſels which enter the Lungs, are the *Trachea* or *Aſpera Arteria*, by which we draw in the Air; the *Arteria Pulmonalis*, which comes from the right Ventricle; and *Vena Pulmonalis*, whoſe Trunk opens in the left Auricle of the Heart: Each of theſe divides into two Branches, for the two great Lobes of the *Lungs*, where they are ſub-divided into as many Branches as there are little Lobes or Veſicles in the *Lungs*. Wherever there is a Branch of the *Trachea*, there is a Branch of the Vein and Artery; and the *Trachea* is always in the Middle. Upon the Branches of the *Trachea Arteria*, which are called *Bronchi*, run a ſmall Artery, called (by Mr. *Ruiſch*) *Arteria Bronchialis*, a ſmall Vein, which *Sommichellius* calls *Vena Pneumonica*. The Artery comes from the *Aorta*, and the Vein opens into the Subclavian. Upon the *Bronchi*, even to their minuteſt Ramifications, run likewiſe the fineſt Threads of the Eighth Pair of Nerves. Beſides theſe, the Lungs have Lymphaticks, which diſcharge themſelves into the Thoracick Duct; but they are ſmaller, and make more frequent Inoſculations than I have obſerved any where elſe.

Of the Trachea Arteria.

Of its Cartilages.

This is the Paſſage of the Veſſels thro' the Lungs; but, becauſe the *Trachea Arteria* has a particular Structure, it demands a particular Examination. It has a Canal ſituated in the fore Part of the Neck, before the *Oeſophagus*; its upper End is called *Larynx*, from whence it deſcends to the fourth *Vertebræ* of the Back, where it divides, and enters the Lungs. This Canal is made of Annular Cartilages, which are at ſmall and equal Diſtances from one another. Theſe Cartilages grow ſmaller and ſmaller, as they approach the Lungs; and thoſe of the *Bronchi* are ſo cloſe to one another, that, in Expiration, the ſecond enters within the firſt, and the third within the ſecond, and ſo the following always enters the preceeding. Betwixt the *Larynx* and the *Lungs*, theſe Cartilages make not compleat Rings; but their hind Part, which is contiguous to the *Oeſophagus*, is membranous, that they may the better contract and dilate, and give way to the Aliments as they go down the *Oeſophagus.* But the Cartilages of the *Bronchi* are compleatly annular; yet their Capillary Branches have no Cartilages, but, inſtead of them, ſmall Circular Ligaments, which are at pretty large Diſtances from one another. The Uſe of the Cartilages is to keep the Paſſage for the Air always open; but in the Capillary *Bronchi* they would hinder the ſubſiding of the Veſicles.

Of its Membranes.

Theſe Cartilages are tied together by two Membranes, the one external, and the other internal. The external is compoſed of circular Fibres; it covers the whole *Trachea* externally. The internal is of an exquiſite Senſe, it covers the Cartilages internally. It is compoſed of three diſtinct Membranes: The firſt is woven of two Orders of Fibres. Thoſe of the firſt Order are longitudinal; for the ſhortning the *Trachea,* they make the Cartilages approach and enter one another. The other Order is of circular Fibres, for the contracting of the Cartilages. When theſe two Orders of Fibres act, they help, with the external Membrane, in Expiration, in Coughing, and in altering the Note of our Voice. The ſecond Membrane is altogether glandulous, and the excretory Veſſels of theſe Glands open in the Cavity of the *Trachea*; they ſeparate a Liquor for the moiſtning the Cavity, and for defending it from the Acrimony of the Air. The third and laſt is a Net of *Veins, Nerves,* and *Arteries.* The *Veins* are Branches of the *Vena Cava*; the *Nerves* of the *Recurrent*; and the *Arteries* of the *Carotides.*

Of the Uſe of the Lungs.

From the Structure of the *Lungs* thus explained, the learned *Pitcairn* has mechanically deduced the great Effect they, by Means of the Air, produce upon the Blood. For, whilſt the *Fœtus* is in the Womb, the Veſicles of the *Lungs* lying flat upon one another, compreſs all the Capillary Blood-Veſſels which are ſpread upon them: But as ſoon as we are born, the Air, by the Dilatation of the *Thorax*, is thruſt into the Branches of the *Trachea Arteria*, and blows up the Veſicles into Spheres; by which Means the Compreſſion being taken off from the Blood-Veſſels, and they equally expanded with the Lungs, all the Blood has a free Paſſage thro' the Pulmonary Artery. But when the Air is thruſt out again by the Contraction of the Cavity of the *Thorax*, it being a fluid Body, compreſſes the Veſicles and Blood-Veſſels upon them every where equally. By this Compreſſion, the red Globules of the Blood, which, through their languid Motion in the Veins, were grown too big to circulate in the fine Capillary Veſſels, are broken and divided again in the *Serum*, and the Blood made fit for Nutrition and Secretion. This Preſſure of the Air upon the Blood-Veſſels may be demonſtrated to be equal to 100 Pound Weight; and in Coughing, or Crying, it may exceed 400 Pound.

But though theſe are the neceſſary Conſequences of Reſpiration, yet ſeveral Experiments incline me to think, that ſome Particles of the Air muſt likewiſe enter the

Blood-veſſels, and mix with the Blood in the *Lungs*. For, Firſt, I am aſſured, from repeated Experiments, that Air will eſcape through the Pores of any Number of Bladders, when compreſſed only by the Weight of the Water into which it is ſunk; and therefore the Preſſure of 100 Pound Weight, in ordinary Reſpiration, muſt thruſt ſome Particles of it into the Blood-veſſels. Secondly, The Honourable Mr. *Boyle*, in his new *Pneumatical Experiments*, ſhews us, That Animals cannot live when ſhut up in common Air, though, by a Gage he has found it to retain its wonted Preſſure, and though the Receiver has been immerſed in Water, cooled with a Solution of Sal Armoniack. The ſame *Experiments* aſſure us, That Animals will live longer ſhut up in compreſſed Air, than in common Air; and that, when they are dying in the common Air, they may be revived by preſſing in more freſh Air. What Mr. *Boyle* ſays, I have likewiſe experienced to be true, with this Difference, that as the Animal ſhut up in uncompreſſed Air grew weak, ſo the Mercury in the Barometer (which was uſed for a Gage) ſunk; and when the Animal died, it had fallen near one third of an Inch, and therefore it is plain, that the Preſſure or Elaſticity of the Air was diminiſhed by the Animal; and when the Animal was dead, the Air by Degrees recovered its former Preſſure, and raiſed the Mercury to the ſame Height as before; though I am ſure there was no Communication with the external Air, having tried the Experiment more than once. What other

Account can be given of this, but that the Animal did ſuck in ſome of the elaſtick Particles of the Air, which, when dead, were emitted again? All which, I think, do ſufficiently prove, that the Air does mix with the Blood in the Lungs. Laſtly, It may be demonſtrated, that the Difference between the Gravity of the Air in the City, and that of the Country, (which can be but very ſmall upon the Account of the *Effluvia*, as the Barometer ſhews it to be) can never be the Cauſe of that Difficulty of Breathing, which ſome have in the one, and not in the other; for they are not near ſo ſenſible of the different Gravities of the Air in the ſame Place, as they are of a much ſmaller Difference in two diſtinct and remote Places, where the Contents of the Air are different.

SECT. VII.

Of the Larynx.

Its Situation.

THE upper End of the *Trachea Arteria* is called the *Larynx*. It lies below the Root of the Tongue, before the *Pharynx*. It is compoſed of five Cartilages, which ſometimes, in old Men become as hard as Bones.

Of the Cartilago Scutiformis.

The firſt is the Θυρεοειδὴς, or *Scutiformis*, becauſe of its Figure. It makes that Protuberance in the fore Part of the *Larynx* called *Pomum Adami*. It is a thin Cartilage about an Inch broad, but not ſo long. It is Concave within, and Convex without. Its four Angles have each a ſmall Production; the two upper, which are longer, are tied to the Horns of the *Os Hyoides*, and the two lower to the ſecond Cartilage, which is called Κρικοειδὴς, or *Annularis*, becauſe it reſembles a Ring. It is very large and thick behind, which Part is like the Stone of a Ring, and it grows narrower to its fore Part; and it is ſituated below the other Cartilages of the *Larynx*; they ſtand upon it as upon a Baſis, and by it they are tied to the *Trachea*.

Of the Annularis.

The third and fourth are alike, and have one common Name, which is the Ἀρυταινοειδὴς. They reach from the Middle of the Concave Side of the *Thyroides* to the upper and back Part of the *Annularis*, and they make that Chink, or *Rimula*, which is the Mouth of the *Larynx*, called *Glottis*. Betwixt thoſe and the Sides of the *Thyroides*, there are two ſmall Cavities on each Side, formed by the Muſcles and Membranes which join them together; in which, if a little Drink or Bread fall, as ſometimes it happens when one laughs, or ſpeaks, in eating or drinking, it cauſes a violent Cough, and a great Tickling.

Of the Epiglottis.

The fifth and laſt Cartilage is the *Epiglottis*; it is of a ſofter Subſtance than the others; it reſembles a little Tongue; it is tied by its Baſis to the upper and middle Part of the concave Side of the *Thyroides*. Its Uſe is to cover the *Glottis* in eating and drinking; for the Aliments, by their Weight, preſs it cloſe down upon the *Glottis*, and they paſs over, without entring the *Larynx*, into the *Oeſophagus*. But when the Aliments are paſt, the *Epiglottis*, by its natural Retort, which is common to all Cartilages, lifts up again, and gives Way to the Air in Breathing. When we ſpeak or laugh, the *Glottis* muſt neceſſarily be open for the Paſſage of the Air; therefore it is not convenient to ſpeak whilſt we ſwallow.

Of the Muſcles of the Larynx.

The *Larynx* has two Pair of common Muſcles, and five Pair proper.

Sternothyroides.

The firſt of the common Muſcles is the *Sternothyroides*; it ariſes from the upper Part of the Inſide of the *Sternum*, and aſcending on the Sides of the *Trachea Arteria*, it is inſerted to the lower Part of the Sides of the *Cartilago Scutiformis*: When theſe Muſcles act, they pull this Cartilage downwards.

Hyothyroides.

The ſecond is the *Hyothyroides*; it ariſes from the lower Part of the *Os Hyoides*, and deſcending, is inſerted into the lower Part of the *Scutiformis*, near the former: They pull up the *Larynx*.

Cricothyroides.

The firſt of the proper Muſcles is the *Cricothyroides*; it ariſes from the fore Part of the Cartilage *Cricoides*, and running under the *Thyroides*, it is inſerted into the Inſide of that Cartilage.

Cryco-Arytænoides.

The ſecond is the *Cryco-Arytænoides Lateralis*; it ariſes from the lateral Part of the *Cricoides*, and aſcending, is inſerted into the lateral Part of the *Arytænoides*; this dilates the *Arytænoides*.

Cryco-Arytænoides Poſticus.

The third is the *Crico-Arytænoides Poſticus*; it ariſeth from the back Part of the Cartilage *Cricoides*, and is inſerted into the *Arytænoides* near the former.

Thyro-Arytænoides.

The fourth is the *Thyro-Arytænoides*; it ariſeth from the internal and concave Side of the *Scutiformis*, and is inſerted into the fore Parts of the *Arytænoides*; it contracts the *Rimula*.

Arytænoides.

The fifth Muſcle is the *Arytænoides*; it runneth upon the upper Part of the Cartilage *Arytænoides*, and, with its Fellow, forms a Sphincter for contracting of the *Rimula*.

A true Squinzie, which is cauſed by the Inflammation of theſe Muſcles, is generally mortal; becauſe they ſhut exactly the Chink of the *Larynx*: Therefore *Bronchotomy* is abſolutely neceſſary in this Caſe, but it is rarely, tho' it may be ſafely uſed.

Of the Veſſels of the Larynx.

The *Larynx* receives Veins from the *Jugulars*, Arteries from the *Carotides*, and Nerves from the *Recurrent*.

Of the Glandulæ Thyroides.

On the lower Part of the *Larynx*, upon the Sides of the annulary Cartilage, and of the firſt Ring of the *Trachea*, there are two Lymphatick Glands called *Thyroideæ*, of the Figure of a Pear; their Colour is red; they have Veins, Nerves and Arteries, as the *Larynx*.

The Uſe of the *Larynx* is not only to form the Voice, but alſo, by the different Apertures of its *Rimula*, the Lungs are more or leſs compreſſed by the Air; for, if the Aperture of the *Larynx* had been as wide as the *Aſpera Arteria*, the Lungs could have ſuffered little or no Compreſſion.

Had it not been for the *Larynx*, we could have received no Benefit by breathing; for, if the Mouth of the *Aſpera Arteria* had been large and wide, the Air had not reſiſted that Force by which it is thruſt out in Expiration, ſo as to make any Compreſſion upon the Lungs, whereby the Globules of the Blood could have been diſſolved, or the Particles of both Fluids mixed together, which we find ſo neceſſary to Life, that we die without it. Nor does the *Larynx* only preſerve Life, but it likewiſe conduces to render it happy and agreeable, by forming the Voice, which is the Sound of the Air drove through the narrow Chink of the *Glottis*, with a Velocity greater than in an ordinary Expiration. This Sound is increaſed by the Cavities of the Mouth and Noſe, which reſound like the Hollow of a Violin, as is evident by the trembling to be felt in the Noſe while we ſpeak. And theſe Cavities not only encreaſe, but alſo conduce to the Agreeableneſs of the Voice; for how diſagreeable is the Alteration of the Voice, which follows a Loſs, or Stoppage of the Noſe? and the Dimenſions of the Mouth are always proportioned to the Notes formed in the *Glottis*, low Notes being conſtantly accompanied with a Promulgation, and high Notes a Contraction of its Cavity. The Notes themſelves are formed by the different Apertures of the *Glottis*: For, when the *Glottis* is contracted, the Air being drove with an equal Force, muſt move more ſwiftly; and the Sides of the *Glottis* being more tenſe, their Vibrations muſt be quicker and ſhorter, and conſequently the Note high. The contrary happens when the *Glottis* windeth.

Each Note is capable of all Degrees of Strength; for the Strength of the Voice is always proportionable to the Quantity of Air thrown out of the *Larynx*, in ſounding of the ſame Note. Now, if the Strength of the Note is to be increaſed, the *Diaphragma*, but more eſpecially the Muſcular Fibres of the *Trachea Arteria*, contract more ſtrongly, and thruſt out a greater Quantity of the Air; and the Aperture of the *Glottis* encreaſes proportionally, that this greater Quantity of Air may paſs through with the ſame Velocity as before, that the ſame Note may be continued.

Now ſuppoſing the greateſt Diſtance of the two Sides of the *Glottis* to be one tenth Part of an Inch in ſounding of 12 Notes (to which the Voice eaſily reaches) this Line muſt be divided into 12 Parts, each of which gives the Aperture requiſite for ſuch a Note, with a certain Strength. But, if we conſider the Subdiviſion of Notes into which the Voice can run, the Motion of the Sides of the *Glottis* is ſtill vaſtly nicer; for if two Chords ſounding exactly Uniſons, one be ſhortned one ſeven thouſandth Part of its Length, a juſt Ear will perceive the Diſagreement, and a good Voice will ſound the Difference, which is one hundred and ninety ſixth Part of a Note. But, becauſe this is a great Nicety, I ſhall only ſuppoſe that the Voice can divide a Note into a hundred Parts; from whence it follows, that the different Apertures of the *Glottis* actually divide the tenth Part of an Inch into one thouſand and two hundred Parts, the Effect of each of which produces a ſenſible Alteration upon a good Ear. But becauſe each Side of the *Glottis* moves juſt equally, therefore the Diviſions are juſt double; or the Sides of the *Glottis*, by their Motion, do actually divide one tenth Part of an Inch into two thouſand four hundred Parts.

CHAP. IV.

Of the upper Cavity, or Head.

SECT. I.

Of the Frontal and Occipital Muſcles; and of the Pericranium.

THE Head is ſituated in the upper Part of the Body, not only for the Conveniency of the Senſes, but alſo that the Brain may the more eaſily ſend the Animal Spirits to all the Parts of the Body.

Its natural Figure is round, but a little flat upon it Sides; round, that it might contain the greater Quantity of Brains; and flat upon its Sides, that the Bounds of the Sight may be the larger, or rather that the Ears might not be too much expoſed to Danger.

We have divided the external Parts of the Head into two, the Face and the hairy Scalp; we ſhall now divide it into the *Containing* and the *Contained* Parts. The *Containing* Parts are the Skin with the Hair upon it, the *Pericranium*, the Skull, and the two *Meninges*. Of the Skin and Hair we have already ſpoken; of the Skull we ſhall ſpeak in its proper Place.

Anatomiſts do generally ſay, That the Skull is covered both with a *Pericranium* and a *Perioſteum*; but they have taken the *Aponeuroſis* of the Occipital and Frontal

Muſcles for one of them. Theſe Muſcles ly immediately under the Skin. The firſt two are called *Frontales.* Their fleſhy Fibres are inſerted into the Eye-brows; from thence they go ſtrait up the *Os Frontis*, and are continued by a long and large *Aponeuroſis* to that of the *Occipitales*; they adhere cloſely to the Skin of the Forehead, which they pull upwards. The other two Muſcles, which are called *Occipitales*, have their fleſhy Fibres fixed to the Skin of the Hind-head, which they alſo pull upwards: They are ſhort, broad, and thin; and they end in a large *Aponeuroſis*, which joins that of the Frontals, and both together cover the whole Skull.

Of the **Pericranium.**

Therefore the *Perioſtæum* or *Pericranium* is a very thin and nervous Membrane of an exquiſite Senſe, which covers immediately not only the *Cranium*, but all the Bones of the Body, except the Teeth. It is tied to the *Dura Mater* by ſome Fibres which paſs through the Sutures of the Skull. It receives Veins from the external Jugulars, Arteries from the *Carotides*, Nerves from the fifth Pair of the Brain, and from the ſecond of the Neck.

SECT. II.

Of the Dura *and* Pia Mater.

THE Membranes or *Meninges*, which are within the *Cranium*, are two, the *Dura Mater* and the *Pia Mater*; ſo called,

becauſe

becauſe they are ſuppoſed to be the Origination of all the Membranes of the Body.

***Of the* Dura Mater.** The *Dura Mater* is a ſtrong and thick Membrane, which covers all the Cavity of the *Cranium*; it contains the whole Brain ſomewhat looſely, that the Veſſels which run between its Duplicature, and upon the Surface of the Brain, be not too much preſſed by the *Cranium*; it ſticks very cloſe to the Baſis of the *Cranium*, and to its Sutures, by the Fibres and Veſſels it ſends to the *Pericranium*; it is faſtned to the *Pia Mater*, and to the Brain, by the Veſſels which paſs from the one to the other. It gives a Coat or Covering to all the Nerves which riſe from the Brain, to the *Spinalis Medulla*, and to all the Nerves which riſe from it. Its Surface is rough towards the *Cranium*, but ſmooth towards the Brain. It is a double Membrane woven of ſtrong Fibres, which may be plainly ſeen on its Inſide, but very hardly on its Outſide next the *Cranium*.

Of its Proceſſes. The *Dura Mater* hath three Proceſſes made by the doubling of its inner Membrane. The firſt riſes by a narrow Beginning from the *Criſta Galli*, to which it is faſtned; and, as it approaches the hind Part of the Head, it grows broader and broader, till it terminates where the longitudinal *Sinus* ends. It divides the *Cerebrum* into two Hemiſpheres, near as deep as the *Corpus Calloſum*. It reſembles a Sickle, therefore it is called *Falx*. The ſecond ſeparates the *Cerebrum* from the *Cerebellum* down to the *Medulla Oblongata*, that the Weight of the *Cerebrum* may not offend the *Cerebellum* which lies under it;

this Proceſs is very ſtrong and thick, and in ravenous Beaſts it is for the moſt Part bony, becauſe of the violent Motion of their Brain. The third is the ſmalleſt; it ſeparates the external Subſtance of the hinder Part of the *Cerebellum* into two Protuberances; and upon it Monſieur *Du Verney*'s fifth *Sinus* runs.

Of the Sinus's *of the* Dura Mater.

In the *Dura Mater* there are ſeveral *Sinus*'s or Channels, which run between its external and internal Membrane; of theſe there are four principal ones which are commonly deſcribed.

Firſt of the Longitudinalis.

The firſt is the *Sinus Longitudinalis*; it riſes from the blind Hole in the upper Part of the *Criſta Galli*; it runs along the upper part of the *Falx*, and ends where it ends: It lies exactly under the *Sutura Sagittalis*. Into this *Sinus* the Veins of the Brain, and ſome of the proper Veins of the *Dura Mater*, bring back the Blood which they receive from the Arteries. Of theſe Veins, ſome running obliquely from the fore Part of the Brain backwards, and others contrary from the hind Part forward, creep a little Space between the Duplicature of the Membrane, as the Ureters do upon the Bladder, and ſo they open in the *Sinus*. In this *Sinus* there are ſeveral ſmall Cells and round Ligaments which go from one Side of the Cavity to the other. Theſe, by their Elaſticity, further the Motion of the Blood.

Laterales.

The ſecond and third *Sinus*'s, which this *Sinus* pours into, are the *Laterales*; they riſe from the End of the firſt, into which they open, and going down upon the Sides of the Occipital Bone, in a crooked Way, they paſs through the ſame Hole with the eighth Pair of Nerves, and diſcharge them into the internal Jugulars. Into theſe *Sinus*'s ſome Veins and the other *Sinus*'s diſcharge themſelves.

Of the fourth Sinus.

The fourth *Sinus* runs by the broad Extremity of the *Falx*, and opens where the Lateral *Sinus*'s join the Longitudinal. This Meeting of the four *Sinus*'s is called *Torcular*. It receives the Blood at its other Extremity from the *Plexus Choroides*.

Of the Sinus Superiores.

Beſides theſe, there are ſix more, which have been deſcribed by ſeveral Anatomiſts. The firſt two are called *Superiores*; they riſe from the hinder Proceſſes of the *Sella Turcica*, or from the *Circular Sinus*'s of Dr. *Ridley*, and run along the upper Part of the internal Proceſſes of the *Os Petroſum*; then deſcending, they open into the *Laterales*.

Of the Inferiores.

There are two more, called *Inferiores*; they riſe from the ſame Place with the other two, and running upon the Union of the *Os Petroſum* with the Occipital, they open into the *Laterales*, juſt as they are going out of the Skull.

A fifth Sinus.

There is a fifth, which the curious Mr. *Du Verney* demonſtrates; it runs upon the third Proceſs of the *Dura Mater*, and divides into two Branches, of which one opens into the *Laterales*, and the other into the *Sinus Vertebrales*. That exact Anatomiſt Dr. *Ridley*, in his *Treatiſe of the Brain*, gives Account of a ſixth, which he calls the *Circular Sinus*, becauſe it ſurrounds the *Glandula Pituitaria*; it communicates with the two *Superiores* and *Inferiores*.

Of the Circular Sinus.

Of three other Sinus's.

Veſalius hath remark'd a *Sinus* which runs along the Bottom of the *Falx*, and which opens into the fourth *Sinus*; this is called by Mr. *Du Verney*, *Longitudinalis Inferior*. There are two more ſituated at the ſecond Proceſs of the *Dura Mater*, one on each Side; they are about an Inch wide from the *Laterales*, into which they open; but theſe three do not always appear.

The Uſe of the Sinus's.

The Uſe of theſe *Sinus*'s is to receive the Blood of the adjacent Parts from the Veins, to which they are as ſo many Trunks which diſcharge the Blood into the internal Jugulars.

Of the Veſſels of the Dura Mater.

The Veſſels of the *Dura Mater* are, firſt, a Branch from the *Carotidal*, whilſt it is in its long Canal, which is diſperſed in the fore and lower Part of the *Dura Mater*. Secondly, an Artery which enters the Hole of the *Cranium*, called *Foramen Arteriæ Duræ Matris*; it is diſperſed on the Sides of this Membrane, and runs as high as the *Sinus Longitudinalis*: The Vein which accompanies the Branches of this Artery goes out of the Skull by the *Foramen Lacerum*. Thirdly, a Branch of the Vertebral Artery and Vein, which laſt paſſes through the Hole behind the Occipital Apothyſis; they are diſperſed in the hind Part of the *Dura Mater*.

The Blood which is brought by the Arteries, is carried back by the Veins which go out of the ſame Holes by which the Arteries enter: But in caſe the Swelling of the Arteries, by a preternatural Fermentation of the Blood, ſhould compreſs the Veins as they go out of the Skull; which might eaſily happen, being it has more Arteries than Veins; therefore there are ſeveral other Veins, which inoſculate with the Arteries, and which carry the Blood from them into two ſmall Veins, which are on the Sides of the Longitudinal *Sinus*'s. It is theſe Veins which open into this *Sinus*, that the Blood which was ſtopped the other Way, may have a free Circulation this Way, as has been ingeniouſly obſerved by Dr. *Ridley*.

It has alſo Nerves from the firſt Branch of the fifth Pair, which give it an exquiſite Senſe. It has a Motion of *Syſtole* and *Diaſtole*, which is cauſed by the Arteries which enter the Skull. No doubt the great Number of Arteries in the Brain contribute more to it, than thoſe few proper to itſelf, which may aſſiſt a little, though not very ſenſibly, becauſe of their Smallneſs and Paucity. The Uſe of the *Dura Mater* is to contain and cover the Brain, the Spinal Marrow, and all the Nerves, to divide the *Cerebrum* in two, and to hinder it from preſſing the *Cerebellum*.

Of the Pia Mater.

The *Pia Mater* is a thin and delicate double Membrane, which lies under the *Dura Mater*, and covers immediately the Subſtance of the Brain. Its inner Membrane is much larger than its outward Membrane; for it runs in betwixt all the Foldings and Circumvolutions of the Brain, to ſeparate them, and to ſuſtain the Blood-veſſels, which make ſeveral Turnings and Windings upon it, before they terminate in the Subſtance of the Brain. It has the ſame Uſe as the *Dura Mater*.

SECT.

SECT. III.

Of the Cerebrum *and* Cerebellum.

The Brain divided into two.

THE whole Subſtance of the Brain is divided into two Parts; that which lies moſtly on the fore Part of the Skull is properly called the *Cerebrum*; and that which lies in the back Part, under the hind Part of the *Cerebrum*, (which is ſupported by the ſecond Proceſs of the *Dura Mater*) is called the *Cerebellum*. Both the one and the other are contained in the *Meninges*, and in the *Cranium*, as in a Caſe of Bones, that nothing may hurt their Subſtance, which is ſoft.

Of the Figure and Subſtance of the Cerebrum.

The *Cerebrum* is of a round Figure, it is divided by the firſt Proceſs of the *Dura Mater* into the right and left Side. Its external Surface reſembles the Turnings and Windings of the Inteſtines. In the *Cerebrum* we diſtinguiſh two different Subſtances, the external, which is of an aſhy Colour; and the internal, which is of a white Colour. Its external Subſtance is called *Subſtantia Corticalia*, or *Sineracea*; it is ſoft, glandulous, and of the Colour of Aſhes. Its internal, called *Subſtantia Medullaris*, is firmer, white, and fibrous; of it the Nerves are made, and it reaches to the Extremity of the *Medulla Spinalis*, where it divides into Fibres.

The external Subſtance of the Brain, by its Circumvolutions, reſembles the ſmall Guts; and in the Middle of each Circumvolution is the Beginning of the Medullary Subſtance: So that the Cortical Subſtance is always on the external Side: And the inner *Lamina* of the *Pia Mater* is co-extended with the Cortical Subſtance, which it immediately covers every where.

Malpighius, who has examined this Cortical Subſtance, ſays, That it is nothing but a Heap of little oval Glands, which receive the Capillary Branches of the Veins and Arteries which belong to the Brain, and which ſend out an infinite Number of Fibres which all together make up the Medullary Subſtance, which going out of the *Cranium*, forms the Nerves and *Medulla Spinalis* contained in the *Vertebræ*.

A general Idea of the Structure of the Brain.

The internal Subſtance of the right and left Side of the Brain coming to join one another, leave a Space between them, which forms the three Ventricles, or *Centrum Ovale*; the upper Part or Covering of this Space is called the *Corpus Calloſum*; the Bottom of this Space is the internal Subſtance of the two Sides of the *Cerebrum*, gathered together, as it were, in two Bundles, which are called *Crura Medullæ Oblongatæ*; upon them are the Protuberances called the *Corpora Striata*, and the *Thalami Nervorum Opticorum*. Theſe *Crura* uniting make one Body, called the *Medulla Oblongata*, upon which there are four Prominences called *Nates* and *Teſtes*: And behind theſe Prominences, the Internal or Medullary Subſtance of the *Cerebellum* being alſo divided into two Bundles, forms upon each Side of the *Medulla Oblongata* three more Protuberances; and then it paſſes out of the *Cranium* into the *Vertebræ*, where it gets the Name of *Medulla-Spinalis*. This is a general Idea of the Structure of the Brain, for the better underſtanding its Parts: Which we ſhall now deſcribe in particular.

Below the Depth of all the Circumvolutions of the Brain, the firſt Thing that appears immediately under the firſt Proceſs of the *Dura Mater* is the *Corpus Calloſum*, or the Covering of the two lateral Ventricles, formed by the Union of the Medullary Fibres of each Side.

Of the two Ventricles.

This being laid aſide, the two lateral Ventricles appear; they reach from the fore Part of the *Cerebrum* backwards; they are pretty broad in their hind Part, but they grow narrower towards their fore Part. They are divided into the right and left Ventricle by a thin tranſparent Membrane, which comes from the under Side of the *Corpus Calloſum*, and is extended to the *Fornix*, which is in the Bottom of the Verticles; this Membrane is called *Septum Lucidum*. I am apt to think it is a Production of the *Pia Mater* which covers all the Sides of the Ventricles.

Of the Septum Lucidum.

In theſe two Ventricles there are four Prominences, two in each Ventricle.

Of the Corpora Striata.

The foremoſt two are called *Corpora Striata*, which are the Tips of the *Crura Medullæ Oblongatæ*. They are oblong, and their Extremities come down upon the Sides of the two other Prominences: they are of a cineritious Colour without, but in their internal Subſtance there are many white Streaks, which are the Medullary Subſtance mixed with the cineritious or glandulous. They are, as it were, tied together by a Medullary Proceſs, called (by *Vicuſſius*) *Commiſſura Craſſioris Nervi Æmula.*

Of the Thal. Nerv. Opt. The two other Prominences are called *Thalami Nervorum Opticorum,* becauſe the Optick Nerves riſe out of them; they are Medullary without, but a little Cineritious within; they are of an oblong Figure; they are upon the upper Part of the *Crura Medullæ Oblongatæ:* Between them there is a Medullary Tract, which encompaſſes them, called (by *Willis*) *Limbi Poſteriores Corporum Striatorum.*

Of the Plexus Choroides. Upon them alſo lies the *Plexus Choroides,* made of Veins, Arteries, and little Glands. Dr. *Ridley* ſays, He has ſeen Lymphaticks riſe from it. This *Plexus* reaches from one lateral Ventricle to the other, paſſing under the *Fornix,* above the third Ventricle. It ſends a Branch to the fourth *Sinus* of the *Dura Mater.*

Of the Fornix. In the Middle, above the *Corpora Striata* and the *Thal. Nerv. Opt.* there lies a thin and broad Production of the Medullary Subſtance, which comes from the fore Part of the Ventricles by two Roots, and reaches to the hinder Part, where it ends by two other Protuberances called its *Crura,* which cover a great Part of the *Thal. Nerv. Opt.* This Production is called the *Fornix,* becauſe it is a Covering to the third Ventricle.

Of the third Ventricle. Under the *Fornix* there is a *Rima* between the *Crura Medullæ Oblongatæ,* which is the third Ventricle, it being a little dilated in its fore Part: There is a Hole that goes down to the *Glandula Pituitaria*; this Hole is the

Of *the* Infundibulum.

Entry to the *Infundibulum*, or Funnel, ſo called becauſe of its Figure. It has a ſmall Conduit made of the Medullary Subſtance covered with the *Pia Mater*; it pierces the *Dura Mater* upon the Baſis of the Skull, and ſinks into the Subſtance of

Of *the* Glandula Pituitaria.

The *Glandula Pituitaria*, which is ſituated in the *Sella Turcica* cloſely covered with the *Pia* and *Dura Mater*; it is of a harder Subſtance than the other Glands of the Body; it receives the End of the *Infundibulum*, which carries a Liquor from the Ventricles into this Gland, which is ſurrounded by the *Rete Mirabile*, or a *Plexus* of ſome Branches of the *Carotidal* and *Cervical Arteries*, which break the *Impetus* of the Blood, and abate the Velocity, as it paſſes through the tender Subſtance of the Brain.

Of *the* Rete Mirabile.

Of *the* Anus.

But to return to the third *Ventricle*. In its hinder Part there is another ſmall Hole, called *Anus*, which leads into the fourth *Ventricle* in the *Cerebellum*. In the upper Part of this Hole is ſituated the *Glandula Pinealis*, (*Des Cartes*'s pretended Seat of the Soul) about the Bigneſs of a Pea; it is compoſed of the ſame Subſtance with the reſt of the Brain, and for the ſame Uſe. It is tied by ſome Fibres to the

Glandula Pinealis.

Nates.

Nates, which are two Prominences of the *Medulla Oblongata*, ſituated above the fore Part of the Conduit, which leads from the *Anus* to the fourth *Ventricle*; they are of an oval Figure, pretty big; and immediately behind them are two other Prominences of the ſame Figure and Subſtance called *Teſtes*, both covered with a Net of Blood-veſſels. There

Teſtes.

There is a ſmall tranſverſe Medullary Protuberance behind the *Teſtes*, from which the *Pathetick Nerves* riſe.

Iſthmus. The Conduit which reaches from the *Anus* to the fourth *Ventricle*, is in that Part of the *Medulla Oblongata*, which is betwixt the *Cerebrum* and the *Cerebellum*, called the *Iſthmus*. The upper Part, or Cover of this Conduit, which is betwixt the *Teſtes* and the foremoſt vermicular Proceſs of the *Cerebellum*, to which two it is tied at its two Ends, and to the Proceſſes that come from the *Cerebellum* to the *Teſtes*, at its Sides, is called

Valvula Major. *Valvula Major:* It is of a Medullary Subſtance; its Uſe is to keep the *Lympha* from falling out above the Nerves in the Baſis of the Skull. Theſe are all the Parts belonging to the *Cerebrum*.

Cerebellum. Now the *Cerebellum*, which is much leſs, is alſo compoſed of a Cortical and Medullary Subſtance; its Superficies makes not Turnings and Windings as that of the *Cerebrum*; but its Foldings are ſtrait, and they reſemble the Segments of Circles, or the Edges of Plates laid in one another; and theſe Segments are largeſt in its Middle, and they grow leſs as they approach its fore and hind Part; where they ſeem to reſemble two

Proceſſus Vermiformes. Worms, therefore called *Proceſſus Vermiformes*.

The Medullary Subſtance of the *Cerebellum*, as it approaches the *Medulla Oblongata*, gathers together, and then divides equally into two Bundles, which are joined to the two Sides of the *Medulla Oblongata:* As they ſeparate, they leave a little Space upon the upper Side of the *Medulla*, which is called the fourth *Ventricle*; and its farther End, because of its Reſemblance, *Calamus Scriptorius*. The Top of this *Ventricle* is covered with ſeveral Blood-veſſels woven like a Net.

Of the fourth Ventricle.

The Medullary Subſtance of the *Cerebellum* makes three Proceſſes upon each Side of the *Medulla Oblongata*. The firſt two go on each Side of it to the *Teſtes*; the *Valvula Major* is betwixt them. The ſecond two are pretty broad; they go ſtraight down on each Side, and meet on the under Side of the *Medulla*; they make that Protuberance called *Proceſſus Annularis*. And the third goes backwards upon the upper Sides of the *Medulla*; they make it look bigger, being like two Cords upon its Sides.

Of the Proceſſes of the **Cerebellum.**

Proceſſus Annularis.

This is all that is remarkable in the *Cerebrum*, *Cerebellum*, and upper Side of the *Medulla Oblongata*. But if you turn over the Brain, you may ſee diſtinctly the Riſe of all the Nerves, the *Infundibulum*, two white Spots behind it, the *Crura Medullæ Oblongatæ*, one on each Side of the *Cerebrum*. Where they join, you may ſee the *Proceſſus Annularis*, or *Pons Varolii*: And beyond that, there are two Prominences called *Corpora Pyramidalia*; they are about an Inch long; and on each Side of them, towards their lower End, there are two more, which, becauſe of their Figure, are called *Corpora Olivaria*; and then the *Medulla Oblongata* goes out of the Skull, being contained in the *Pia* and *Dura Mater*.

Corpora Pyramidalia.

and **Olivaria.**

Obſerve, That the *Medulla Oblongata*, with all the Protuberances which are upon its upper and lower Sides, are not purely of the Medullary Subſtance, but internally they are mixed with the Cortical; and it is this Mixture which makes thoſe *Striæ* to which they have given different imaginary Uſes, according to their different Poſitions.

Now the Veſſels of the Brain are Nerves, Veins, and Arteries. The Nerves are ten Pair. The firſt Pair are the Olfactory Nerves; they riſe from the Baſis of the *Corpora Striata*, and paſs through the Holes of the *Os Cribriforme*. The ſecond Pair are the Optick Nerves; they riſe partly from the Extremities of the *Corpora Striata*, and partly from the *Thalami Nervorum Opticorum*, which they almoſt embrace: They unite together above the *Cella Turcica*, and, immediately dividing again, they paſs through the two foremoſt Holes in the *Os Sphenoides*. The third Pair are the Movers of the Eyes; they riſe on each Side of the *Infundibulum* from the *Medulla Oblongata*, and go out at the *Foramina Lacera*. The fourth Pair are the Pathetick Nerves; they riſe from the ſmall Medullary Cord which is behind the *Teſtes*, and paſs through the *Foramina Lacera*. The fifth Pair riſe from the fore Part of the *Proceſſus Annularis*; they give Nerves to the *Dura Mater*; each of them divides into three Branches, the firſt paſſes out of the *Foramen Lacerum*, the ſecond at the third Hole of the *Os Sphenoides*, and the third through another Hole of the ſame Bone. The ſixth Pair riſes from the Sides of the *Proceſſus Annularis*, and goes out at the *Foramen Lacerum*; but, juſt before it goes out, it caſts back a Branch, which makes the Root of the Intercoſtal Nerve; this goes out at the Canal through which the Carotidal Artery enters. The ſeventh is the Auditory Nerve; it riſes from the hind Part of the *Proceſſus Annularis*, and enters the Hole in the Proceſs of the *Os Petroſum*. The eighth Pair is the *Par Vagum*; it riſes from the *Medulla Oblongata* behind the *Proceſſus Annularis*, by ſeveral Threads which join in one, and it goes out at the ſame Hole the Lateral *Sinus*'s open into the *Jugulares*. The ninth Pair riſes from the *Proceſſus Olivares* of the *Medulla Oblongata*, and paſſes out at a Hole in the Occipital Bone, which is proper to itſelf. The tenth and laſt Pair riſes by ſeveral Fibres from the Beginning of the *Medulla Spinalis*; from thence aſcending within the *Occiput*, it turns and paſſes out at the ſame Hole through which the Vertebral Artery enters, between the firſt *Vertebræ* and the Occipital Bone, running through a *Sinus* in this *Vertebra*. Theſe are the Nerves of the Brain, which we ſhall trace farther in the eighth Chapter.

Of the Veſſels of the Brain.

The Arteries are the two internal Carotidals which paſs through two oblique Canals in the *Oſſa Petroſa*: As ſoon as they enter the Skull, they give a Branch which enters the Orbit of the Eye; they give Branches which make the *Rete Mirabile*, then they pierce the *Dura Mater* on each Side of the *Infundibulum*; they communicate with the Cervical Artery, and they give Branches to the *Plexus Choroides*, and are diſtributed through all the Subſtance of the Brain: Their Branches make many Turnings and Windings upon the *Pia Mater,* and at laſt are loſt in the little Glands of the Cortical Subſtance of the Brain.

The two Vertebral Arteries, which come out of the Holes in the tranſverſe Proceſſes of the *Vertebræ,* enter the large Hole of the Occipital Bone; they pierce the *Dura Mater,* and go along the under Side of the *Medulla Oblongata;* then they caſt back two Branches for the Spinal Arteries, and at the *Proceſſus Annularis* they join in one Branch called the *Cervical Artery.* This communicates with the two *Carotides,* by two Branches called the *Communicant Branches;* then it divides again into two, which give Branches to the *Rete Mirabile, Plexus Choroides;* and they are afterwards diſtributed through all the Subſtance of the Brain, ending in the cineritious Subſtance, as the *Carotidales.*

The Veins enter not the *Cranium* at the ſame Holes that the Arteries do, becauſe, as Dr. *Ridley* rightly obſerves, upon any Fermentation of the Blood, the Swelling and Pulſe of the Arteries would compreſs the Veins againſt the bony Sides of their Paſſage, and ſo cauſe a Stagnation and Extravaſation of the Blood in the Brain, which would be the Deſtruction of the whole Machine. Neither do the Veins run along by the Sides of the Arteries in the Brain, as they do through all the reſt of the Body; but they riſe from the Extremities of the Arteries, in the cineritious Subſtance of the Brain, and go ſtraight to diſcharge themſelves into the *Sinus*'s of the *Dura Mater.*

The Uſe of the Brain.

The Blood which is brought into the Brain by the Carotidal and Vertebral Arteries, is ſeparated by the Glands which make the Cineritious and Cortical Subſtance of the Brain, from its fineſt and moſt ſubtil Parts, called Animal Spirits, which are received from the Glands by the Fibres of the Medullary Subſtance, which is the Beginning of the Nerves. Each Nerve therefore is a Bundle of very fine and ſmall Tubes, of which ſome are no bigger than the hundreth Part of an Hair; and theſe Tubes are the excretory Ducts of the Cineritious, or Glandulous Part of the Brain. This does not only appear from the Structure of the Brain, but by Reaſon likewiſe we are aſſured, that there is ſuch a Fluid as we call Animal Spirits running in the Nerves. For ſeeing all Senſation is performed by the Nerves, it muſt be done either by the Subſtance of the Nerve, or the Fluid which is contained in the Nerve: If by the Subſtance of the Nerve, it muſt be by a Vibration from the Part upon which the Impreſſion is made to the Brain. Now that there can be no Vibration from the Impreſſion of external Objects upon Animal Nerves, which are ſlack, and ſurrounded all along by other Bodies, is evident; and therefore Senſation muſt be performed by the Fluid in the Nerves.

The Motion of this Fluid is not ſwift and rapid, as is generally ſuppoſed, but ſlow and languid, ſeeing all its Motion proceeds from the Dilatation of the Arteries compreſſing the ſoft Subſtance of the Nerves, and from the Force by which it is thruſt through the Glands of the Brain. And when the Nerves are full of this fine Fluid, the Impreſſions of

Objects may be communicated to the Brain without any quick Motion in the Animal Spirits, either by retarding or ſtopping their progreſſive Motion, or by cauſing Undulation. If to theſe we add, that the Animal Spirits muſt be confined within their own proper Channels, as well as the other Fluids of the Body; we ſhall eaſily perceive how precarious the many ingenious Hypotheſes are, which the learned *Willis* has elegantly deſcribed in his *Syſtem of the Nerves and nervous Diſtempers.*

SECT. IV.

Of the Eyes.

THE Organs of Sight are divided into two Parts: The internal Part, which is the Globe or Body of the Eye; and the external Part, which is thoſe Parts about the Globe ſubſervient to it.

Of the Eye-brows. The firſt of theſe laſt are the Eye-brows, which are nothing but ſome Hairs bunching out above the Eye, by ſome Fat which is under the Skin in this Place. They break the Rays of Light, that they be not directly darted into the Eyes, which would greatly offend the Sight, as they do when we look directly upon the Sun.

The Eye-lids. The next are the Eye-lids, two to each Eye. The upper Lid moves very quickly, the under very undiſcernably.

Its Muſcles. The upper Eye-lid is lifted up by the *Muſculus Rectus*, which riſes from the Bottom of the Orbit of the Eye, where the Optick Nerves pierce the *Cranium*; and, paſſing above the *Muſculus Superbus*, it is inſerted by a large Tendon to the Border of the Eye-lid.

Both Lids are brought together to ſhut upon the Eye by another Muſcle called *Orbicularis*. It riſes from the great Angle of the Eye, and its Fibres are ſpread two Fingers Breadth, covering the under Lid: they reach to the little *Canthus*, from which continuing its Circular Fibres which cover the upper Lid, it is inſerted into the ſame Place from which it aroſe. Some Authors divide this Muſcle into two, the Superior and Inferior, which they make to riſe from the great *Canthus*, and to be inſerted into the little *Canthus*.

Of the Conjunctiva.

The Eye-lids are covered within with a ſmooth Membrane called *Conjunctiva*; becauſe it is continued upon the fore Part of the Globe, conſtituting that which we call the white of the Eye; it joins the Globe to the Edges of the Orbit.

Of the Cilia.

The Edges of the Eye-lids have two ſmall and ſoft Cartilages, like the Segments of a Circle, called *Cilia*; they keep the Eye-lids extended, that every Part may be equally raiſed. Upon them there is a Rank of ſmall Glands, whoſe Exeretory Channels open upon the Edges of the Lids. They yield a Wax which faſtneth the Eye-lids together whilſt we ſleep. They are covered with the Skin externally, and with the *Conjunctiva* internally. Upon the Edges of the Lids there are alſo ſome Hairs in Form of a Paliſado, to preſerve the Eyes, as the Eye-brows do, and to hinder any Filth or Flies from falling into the Eyes.

Of the Glandula Lachrymalis.

On the back Side of the *Conjunctiva*, upon the upper Part of the *Globe*, is the *Glandula Lachrymalis*, pretty large, divided into ſeveral Lobes, each of which ſends out an Excretory Channel which opens in the fore Side of this Membrane, where it covers the upper Lid. This Gland ſeparates the Matter of the Tears, which, by the continual Motion of this Lid, moiſten the *Cornea*, which otherwiſe would dry and wrinkle by the continual Action of the external Air.

The Edges of the Eye-lids being of an equal Convexity with the Ball of the Eye, which they touch, as the Tears fall from off the *Cornea*, they are ſtopt by the Edge of the under Eye-lide, along which they run, till they fall into two ſmall Holes in the great *Canthus* of the Eye, one in each Eye-lid. Theſe Holes are called *Puncta Lachrymalia*: They lead to a ſmall membranous Bag, which is ſituated in this Corner, upon the *Os Lachrymale*; from the Bottom of which there goes a ſmall Pipe, which pierces this Bone into the Noſe, and opens under the upper *Lamina* of the *Os Spongioſum*. It moiſtens the inner Membrane of the Noſtrils, by the Humour of the Lachrymal Gland, which runs from off the Globe into them. Sometimes the Acrimony of this Humour cauſeth Sneezing, which we hinder, by preſſing the Angle of the Eye, and ſo ſtop its running.

Puncta Lachrymalia.

Between theſe two *Puncta* there is a Caruncle, which ſerves to keep them open when the Eyes are ſhut: This Caruncle was thought to be the *Glandula Lachrymalis.*

The Globe of the Eye is moved by four ſtrait Muſcles, and two oblique; and betwixt them there is a great deal of Fat, which facilitates the Motion of the Globe.

Of the Muſcles of the Eyes.

The firſt of the four ſtrait Muſcles is called *Attolens*, or *Superbus;* it lies upon the upper Part of the Globe; it pulleth up the Eye when we look up. The ſecond is called *Deprimens*, or *Humilis;* it pulleth down the Eye. The third is called *Adductor;* it draweth the Eye towards the Noſe. The fourth *Abductor;* it draweth the Eye toward the little *Canthus*. They riſe all four from the Circumference of the Hole in the Orbit, thro' which the Optick Nerves paſs; and they terminate about the *Cornea* by four thin and broad Tendons. When they all act together, they draw the Eye towards the Bottom of the Orbit. When the *Superbus* and the *Adductor*, or the *Abductor*, act together, or the *Humilis* and the *Adductor*, or *Abductor*, act together, they perform the oblique Motions, which have been attributed to the oblique Muſcles.

The firſt of the oblique Muſcles, which is the fifth of the Eye, is the *Obliquus Minor;* it riſes from the lower Side of the Orbit near its external Circumference, where the firſt and ſecond Bones of the upper Jaw join together, and aſcending obliquely by the outer Corner of the Eye, it is inſerted to the upper and external Side of the Globe behind the Tendon of the *Abductor*.

The ſecond of the oblique Muſcles, and

the ſixth of the Eye, is the *Obliquus Major;* it riſes from the Bottom of the Orbit; and marching obliquely towards the great *Canthus*, in the upper Part of which, near the Brink, there is a Cartilaginous Ring, thro' which it paſſes its round Tendon; from whence reverting backwards, it is inſerted into the upper Part of the Globe, behind the Tendon of the *Attollens.*

The Uſe of the firſt of theſe Muſcles is to draw the Globe of the Eye forwards, and to turn its Pupil upwards; and of the ſecond, to draw it forwards, and to turn its Pupil downwards, for the better receving of the Rays of Light, which could not be performed by any of the other four Muſcles (as Mr. *Cowper* has very well obſerved.) And both of them are an Axis for ſuſpending the Globe, by which, in its almoſt continual Motion, it is moved the more eaſily, as has been ingeniouſly obſerved by Monſ. *de la Hire.*

Now the Globe of the Eye is of a Spherical Figure; in it are contained the principal Inſtruments of Viſion; it is compoſed of Coats and Humours.

Of the Conjunctiva. The firſt Coat is the *Conjunctiva;* it makes the White of the Eye; it hath been already deſcribed: It is full of ſmall Veins and Arteries, which appear big in an *Ophthalmia* or Inflammation of the Eyes.

Sclerotica. The ſecond is called *Sclerotica;* it is thick, hard and ſmooth, opake behind, but tranſparent before, where it makes the

Cornea. Third Coat, called *Cornea*, becauſe it is tranſparent, like the Horn of a Lantern, in the fore Part of the Eye, which is ſurrounded ed by the White of the Eye: It has a greater Convexity than the reſt of the Globe of the Eye, and is compoſed of ſeveral parallel *Laminæ*, which are nouriſhed by many Blood-Veſſels, ſo fine, as not to hinder even the ſmalleſt Rays of Light from entring the Eye; and it has a moſt exquiſite Senſe, that, upon the leaſt Pain, the Tears might be ſqueez'd out of the Lachrymal Gland, to waſh off any Filth, which, by ſticking to the *Cornea*, might render it opake.

Choroides. The fourth is the *Choroides*; it lies under the *Sclerotica*, it is much thinner than it: It hath a great Number of Blood-Veſſels which come from the ſecond, and which are ſpread upon it; as alſo ſeveral Glands, which ſeparate from the Blood-Veſſels a black Liquor which tinctures all this Membrane internally, which is otherwiſe of a whitiſh Colour. This Coat is open, or has a Hole before, for the Paſſage of the Rays of Light, called *Pupilla*. That Part of this Coat, which makes the Circumference of this Hole, and which lies upon the Sides of the Cryſtalline Homour, is

Uvea. The fifth Coat called *Uvea*, which is made of circular and ſtraight Fibres; it contracts and dilates, according to the different Impreſſions of Light and of Objects.

Iris. The *Iris* is the Outſide of the *Uvea*, where the different Colours appear. On the Inſide of the *Uvea*, from its Circumference, which joins the *Choroides*, riſes the *Ligamentum Ciliare*. It is made of ſhort Fibres, which run upon the fore Part of the glaſſy Humour to the Edges of the Cryſtalline, like Lines drawn from the Circumference to the Centre. By the Contraction of theſe Fibres the fore Part of the Eye is made more prominent, and the *Retina* preſſed farther back from the Cryſtalline Humour, or the *Axis* of Viſion is lengthned when Objects are placed too near the Eye.

Retina.

The ſixth is the *Retina*, ſo called, becauſe it reſembles a Net which covereth the Bottom of the Cavity of the Eye: It is a fine Expanſion of the Medullary Fibres of the Optick Nerve upon the Surface of the glaſſy Humour, as far as the *Ligamenta Ciliaria.* It is on this Coat that the Impreſſions of Objects are made.

Of the Aqueous Humour.

The Humours of the Eye are three: the firſt is called the *Aqueous*; it lies in the fore Part of the Globe, immediately under the *Cornea*; this Humour is thin and liquid, of a ſpirituous Nature, for it will not freeze in the greateſt Froſt. This evinces the Neceſſity of a continual Supply for this Humour, which, in effect, it hath. For if the *Cornea* be pricked, and this Humour ſqueezed out, it ſhall be reſtored again in the Space of ten or twelve Hours.

Cryſtalline Humour.

The ſecond Humour is the Cryſtalline; it lies immediately next to the *Aqueous*, behind the *Uvea*, oppoſite to the *Pupilla*, nearer to the fore Part than the back Part of the Globe; it is the leaſt of the Humours, but much more ſolid than any of them: Its Figure, which is convex on both Sides, reſembles two unequal Segments of Spheres, of which the moſt convex is its back Side, which makes a ſmall Cavity in the glaſſy Humour in which it lies: It is covered with a fine Coat, called *Aranea*.

Of the Vitrious Humour.

The third is the glaſſy Humour; it hath a great Reſemblance to the White of an Egg; it filleth all the hind Part of the Cavity of the Globe. It is in a greater Abundance than the other two. It is thicker than the Aqueous, but thinner than the Cryſtalline Humour. It is contained in a very fine Coat of the ſame Name. It gives the Spherical Figure to the Eye. Upon its back Part the *Retina* is ſpread, which it holdeth from the Cryſtalline Humour at a Diſtance requiſite to receive the Impreſſion of Objects diſtinctly.

The Optick Nerves pierce the Globe of the Eye a little on the Inſide of the Optick *Axes*. Their external Coat, which is a Production of the *Dura Mater*, is continued to the *Sclerotis*, as their Internal from the *Pia Mater* is to the *Choroides*; and their Medullary Fibres paſſing through all, are expanded into the *Retina*, upon which the Images of Objects are painted. The Center of this Expanſion is inſenſible, and all Rays which fall upon it are loſt; and conſequently, that Point of the Objects from which theſe Rays come, is inviſible to the Eye, as is evident from that famed Experiment of Monſieur *Mariot*. The Reaſon of this Inſenſibility proceeds probably from the Blood-Veſſels which enter with the Optick Nerve, and cover this Part of the *Retina*. But, whatſoever its Cauſe is, we are extremely obliged to the Maker of our Eyes, that the Optick Nerves are inſerted on the Inſide of the Optick *Axes*: For if they had pierced the Globe of the Eye in the Optick *Axes*, then the middle Point of every Object had been inviſible; and where all Things conduce to make us ſee beſt, there we had not ſeen at all. We muſt likewiſe have loſt ſome Part of an Object, if the Optick Nerves had been placed on the Outſide of the Optick *Axes*: Becauſe an Object may be ſo placed, as that all the Rays which come from one Point may fall upon the Outſide of both Eyes; but it is impoſſible that they ſhould fall upon the Inſide of both Eyes, and therefore that Point which is loſt in one Eye, is viſible by the other.

Of the Veſſels of the Eyes. The Veſſels of the Eyes are Branches of the external Carotides and Jugulars, which are diſtributed upon the external Parts of the Eyes, and a Vein which opens into the ſuperior *Sinus* of the *Dura Mater*, in the Baſis of the Skull, and an Artery from the internal *Carotid*. They accompany the Optick Nerves, and are diſtributed on the Muſcles and Globe of the Eye.

There are alſo ſome Lymphaticks which accompany the Blood-Veſſels. The Nerves of the Eyes are

Of their Nerves. The Optick Nerves; they are pretty big and round. The third Pair of the Brain, called *Motorii*; the fourth Pair, called *Pathetici*: the firſt Branch of the fifth Pair, called *Ophthalmicus*; and the ſixth Pair, are all beſtowed on the Muſcles of the Eyes.

Of Viſion. All the Rays which come from one Point of an Object, are, by the *Cornea* and Humours of the Eye united in a Point of the *Retina*,

Retina, which is in a ſtraight Line, drawn from the ſame Point of the Object, through the Center of the Eye; and conſequently all the Rays, which come from all the Points of an Object, are united on the *Retina*, in the ſame Order and Proportion as the Points of the Object are from whence theſe Rays come. Therefore the Impreſſion which theſe Rays make upon the *Retina*, muſt be the Image of the Object.

Thus in general Viſion is performed. But now let us ſee what ſeveral Parts of the Globe conduce in this Action. We have ſaid, the *Cornea* was more convex than any other Part of the Globe; by which Means, all the Rays are gathered to paſs through the *Pupilla*, and none of them are loſt upon the *Uvea*.

How the Parts of the Eye contribute to it.

The Aqueous Humour being the thinneſt and moſt liquid, eaſily changes its Figure, when either the *Ligamentum Ciliare* contracts, or both the oblique Muſcles ſqueeze the Middle of the Bulb of the Eye, to render it oblong when Objects are near to us.

The ſtrait Fibres of the *Uvea* dilate the *Pupilla*, when there are but few Rays of Light; and the circular Fibres contract it, when there are too many. When the *Pupilla* is contracted, we ſee moſt diſtinctly; when it is dilated, we ſee moſt clearly. The glaſſy Humour keeps the cryſtalline Humour at ſuch a Diſtance from the *Retina*, as is neceſſary for uniting the Rays which come from one Point of the Object, exactly in one Point of the *Retina*.

The Impreſſion of the Object is made upon the *Retina*. The *Choroides* is tinctured black, that the Rays of the Light which paſs through the *Retina*, may not be reflected back again, to confuſe the Image of the Object.

Being diſtinct Viſion conſiſts in the Union of all the Rays which come from one Point of an Object, exactly in one Point of the *Retina*; and that the Rays which come from Objects at different Diſtances, are united at different Diſtances, behind the cryſtalline Humour; they cannot both be united exactly upon the *Retina*; therefore the Eye cannot ſee equally, diſtinctly at the ſame Time Objects at different Diſtances. It is for this Reaſon, that the Globe of the Eye moves ſo quickly, and almoſt continually, and that the Muſcles of the Eyes have ſuch a great Quantity of Nerves to perform their Motion.

When the Globe of the Eye is flat, as happens ſometimes in old Age, that the Rays paſs the *Retina* before they unite, in ſuch a Caſe there is no diſtinct Viſion; and ſuch as have this Defect, are called *Presbytæ*: And if, on the contrary, the Globe of the Eye be ſo convex as to unite the Rays before they come to the *Retina*, neither is there any diſtinct Viſion; ſuch as have this Defect are called *Myopes*.

SECT. V.

Of the Ear.

Of the External Ear. THE Ear is divided into the External and Internal. The External Ear (whoſe Parts have already been deſcribed) is compoſed of the Skin, a Cartilage, and a little Fat. The Skin of this Part is thin and ſmooth; its Glands ſeem to differ from the Miliary Glands of the Skin, in that both in Young and Old they frequently flow with an unctuous Humour, which dries to a Sort of Scurf in the *Concha*. Theſe Glands are called by *Valſalva, Glandulæ Sebaceæ*. The Skin ſticks cloſe to the Cartilage by Means of the *Membrana Adipoſa*, whoſe Cells contain no Fat but in the Lobe of the Ear, where the Cartilage does not reach. The Veſſels of the External Ear are Arteries from the *Charotid* Veins, which go to the *Jugulares*, and Nerves from the *Portio Dura*, and ſecond Pair of the Neck.

The External Ear is tied to the *Os Petroſum* by a ſtrong Ligament which comes from the Backſide of the *Pinna*. Though the Ear has but a very obſcure Motion, yet it has two Muſcles: The firſt ariſes from the Outſide of the Frontal Muſcle, where it joins the *Crotaphite*, and is inſerted into the upper and back Part of the *Pinna*. The ſecond ariſes from the upper and foremoſt Part of the *Proceſſus Mamillaris*, and is inſerted into the Middle and back Part of the *Concha*. The firſt ſhould draw the Ear upwards, and the ſecond downwards and backwards; but the continual binding of our Ears when young, deprives us of their Uſe.

Of the Meatus Auditorius.

The Uſe of the External Ear is like a Tunnel to gather the Sounds, which by its Ridges and Hollows are directed to the *Meatus Auditorius*, the firſt Part of the Internal

Ear. This is a Conduit which goes from the Middle of the *Concha* to the *Tympanum*: It is near an Inch long, about three or four Lines, or tenth Part of an Inch wide; and its Paſſage is not ſtraight, but crooked, paſſing firſt upwards, then downwards; then it has a ſmall Tendency upwards again, and the lower Part of its Extremity bends a little down to the Obliquity of the *Membrana Tympani*. The Beginning of this Paſſage is Cartilaginous, being a Continuation of the *Concha* contracted; the End of it is *bony*, being in the Temporal *Bone*, which makes the greateſt Part of the upper and back Part of the *Meatus*, as the Cartilage does of the lower and fore Part. The whole Cavity within is lined with a Membrane, which ſeems to be a Continuation of the Skin which covers the *Auricula*, and which grows thinner and thinner as it approaches the *Tympanum*. On the back Side of this Membrane, there is a great Number of little Glands, whoſe excretory Ducts bring into the *Meatus* a yellow Excrement, whoſe Bitterneſs and Viſcidity hinder Inſects from approaching the *Membrana Tympani*, which it likewiſe preſerves againſt the Injuries of the Air. The Cartilage is always ſlit, and frequently in more than in one Place. The *Meatus* has the ſame Veſſels which the External Ear hath, and both have a Vein which paſſes through the eleventh of the External Holes of the *Cranium*, and diſcharges itſelf into the Lateral *Sinus's*.

Of the Membrane of the Tympanum.

The inner Extremity of the *Meatus* is cloſed with a thin tranſparent Membrane, of an Oval Figure ſtretched out like the Head of a Drum, making an obtuſe Angle with the upper and back Part of the *Meatus*, and an acute with the lower and fore Part. This is the *Membrana Tympani*, which is ſet in a bony Circle of the Temporal Bone, and which wants about half a Line of being a compleat Circle. *Valſalva* ſays, that this Membrane is double, being compoſed of the Membranes which line the Cavities of the *Meatus* and the *Tympanum*. The Handle of a ſmall Bone, called the *Malleolus*, is tied to this Membrane, which it draws ſomewhat inwards, making a little Concave towards the *Meatus Auditorius*: And there runs a ſmall Twig of a Nerve from the fifth Pair upon its Inſide, called *Chorda Tympani*. The upper Edge of this Membrane, being ſometimes not quite cloſed to the Bone, gives a Paſſage for the Air from the Mouth to the External Ear.

Of the Tympanum. Behind this Membrane there is a pretty large Cavity called the *Tympanum*; it is about three or four Lines deep, as much wide, and between two and three high. It is lined with a fine Membrane, on which there are ſeveral Veins and Arteries. It is always full of a purulent Matter in Children. In this Cavity there are four ſmall Bones, of which

Of the Malleolus. The firſt is the *Malleolus* or Hammer, ſo called, becauſe of its Shape. Its Head has on its lower Side two Protuberances and a Cavity whereby it is joined to the *Incus* by *Ginglymus*: Its Handle, which is pretty long and ſmall, is faſtned to the *Membrana Tympani*: Its whole Length is about three Lines, or a little the more. Near its Head it has two ſmall Proceſſes, and it is moved by three Muſcles.

Its Muſcles. The firſt is called the *Externus*; it ariſes from the upper and external Side of the *Meatus Auditorius*, and is inſerted into the upper and lower Proceſs of the *Malleolus*, which it draws outwards. This is neceſſary when Sounds are too great, which might break the *Membra Tympani*.

The ſecond is the *Obliquus*; it lies in the external Part of the Conduit which goes to the Palate, and entring the Barrel is contained in a Sinuoſity of the Bone by the upper Edge of the *Membrana Tympani*, and is inſerted into the ſlender Proceſs of the Hammer, aſſiſting the former Muſcle in its Action.

The third is the *Internus*, which ariſes from the Extremity of the bony Part of the Conduit which leads to the *Fauces*, and lies in a *Sinus* of the *Os Petroſum*, till it paſſes over a little riſing of the Bone at the *Feneſtra Ovalis*, to be inſerted into the poſterior Part of the Handle of the *Malleolus*. This Muſcle, by pulling the Hammer inwards, diſtends the *Membra Tympani*.

Of the Incus. The ſecond ſmall Bone is called *Incus*, the Anvil: It has a Head and two Legs. Its Head, which is near two Lines long, above one broad, and but half a Line thick, has a Protuberance and two Cavities, whereby it is articulated with the Hammer; the ſhorter of its Legs is tied to the Side of that Conduit which goes to the *Proceſſus Mammillaris*, and its longer Leg to the Head of the third Bone, called

Of the Stapes.

The *Stapes* or *Stirrup*, becauſe of its Reſemblance. It is of a triangular Figure, being made of two Branches ſet upon a flat Baſis, which ſtands upon the *Foramen Ovale*. The Space between the two Branches is filled up by a fine tranſparent Membrane; the Union of the two Branches is called the Head of the Stirrup, in which there is a ſmall Cavity, in which lies the fourth Bone. The Height of the *Stapes* is a Line and a half, the Length of it is above a Line, and the Breadth half a Line. There is a ſmall Muſcle, which ariſes out of a ſmall Canal in the Bottom of the *Tympanum*, and which is inſerted into the Head of the Stirrup.

Of the Os Orbiculare.

The *Os Orbiculare*, which is a very ſmall Bone, being convex on that Side which is received in the Cavity of the Head of the Stirrup, and hollow on the other Side, where it receives the long Leg of the Anvil, which is only joined to the Stirrup by means of this fourth Bone.

Of the Holes in the Tympanum.

Beſides theſe Bones, there are ſeveral Holes in the *Tympanum*. The firſt is in its fore Part neareſt the *Membrana Tympani*. It is the Entry to the *Sinus* in the Mammillary Proceſs. The ſecond is the Orifice of a Conduit which leads to the Palate of the Mouth. The Beginning of this Paſſage is very narrow and bony; the Middle is Cartilaginous, and its Extremity, which opens near the *Uvulla*, is above four Lines wide, membranous, and dilated by ſome Muſcular Fibres, as *Valſalva* ſays; and they open the Extremity of this Paſſage, either when we open our Mouths to hear more diſtinctly, or when it is neceſſary there be a free Communication between the external Air, and that in the Cavity of the *Tympanum*. The third and fourth are in the internal Proceſs of the *Os Petroſum*. The one is called *Feneſtra Ovalis;* the Baſis of the Stirrup ſtands upon it; it is the Entry to the *Veſtibulum*. The other is called *Feneſtra Rotunda:* It is covered by a fine Membrane, inchaſed in a Rift of this Hole: It leads to the *Cochlea*.

Of the Veſtibulum. The *Veſtibulum* is a Cavity in the *Os Petroſum*, behind the *Feneſtra Ovalis;* it is above two Lines broad, and as much long, and a Line and a half high. In it open the ſemicircular Pipes of the Labyrinth, the upper turning of the *Cochlea*, and Auditory Nerve, at five ſmall Holes.

Of the Labyrinth. The *Labyrinth* is made of three ſemi-circular Pipes above half a Line wide, excavated in the *Os Petroſum;* they open by five Orifices into the *Veſtibulum*. That which is called the ſuperior Pipe, which is generally about five or ſix Lines long, joins one of its Extremities with one of the Extremities of that which is called the inferior Pipe (which is about ſix or ſeven Lines long) and theſe two Extremities open by an Orifice, but the middle Pipe opens at each End by itſelf into the *Veſtibulum*. This is about four or five Lines long.

Of the Cochlea. The laſt Cavity of the Ear is the *Cochlea*: it reſembles a Snail's Shell. Its Canal, which winds in a Spiral Line, is divided into two, the upper and lower, by a thin *Lamina Spiralis*, of which that Part next the *Axis* is bony, but extremely brittle, and that next the outer Shell is Membranous, appearing to be only made of the Auditory Nerve. The upper Canal opens into the *Tympanum*, and the lower into the *Veſtibulum*. This is narrower than that, eſpecially towards the *Baſis* and the *Cochlea*, where each is about a Line wide, and the *Baſis* itſelf is about four Lines in Diameter.

Of the Veſſels of the Ear.

The Veſſels of the internal Ear are Arteries and Veins, from the internal *Carotidale* and *Jugulars*. The *Nervus Auditorius* enters by the Hole in the internal Proceſs of the *Os Petroſum*. It conſiſts of two Bundles, of which one is hard, the other ſoft. Five Branches of the *Portio Mollis* enter the *Veſtibulum*, as has been ſaid, and form a delicate Web, which ſends Slips, which run through the ſemi-circular Canals; and the reſt of the *Portio Mollis* enters the *Cochlea* at the Center of its *Baſis*, and turns with the Spiral Line, of which it probably makes the Membranous Part. The *Portio Dura* paſſes through its proper Paſſage to be diſtributed among the external Parts about the Ear.

Of Hearing.

A Sound is nothing but a certain Refraction or Modulation of the external Air, which being gathered by the external Ear, paſſes through the *Meatus Auditorius*, and beats upon the *Membrana Tympani*, which moves the four little Bones in the *Tympanum*. In like manner as it is beat by the external Air, theſe little Bones move the internal Air, which is in the *Tympanum* and *Veſtibulum*; which internal Air makes an Impreſſion upon the Auditory Nerve in the *Labyrinth* and *Cochlea*, accordingly as it is moved by the little Bones in the *Tympanum:* So that, according to the various Refractions of the external Air, the internal Air makes various Impreſſions upon the Auditory Nerve, the immediate Organ of Hearing; theſe different Impreſſions repreſent different Sounds. The curious Structure of the *Labyrinth* and *Cochlea* render the weakeſt Sounds audible; for the whole Organ of Hearing being included in a ſmall Space, had the Auditory Nerve run in a ſtraight Line, the Impreſſions had been made but upon a very ſmall Part of it; and the Strength of the Impreſſion being *Cæteris Paribus*, always as the Number of Parts upon which the Impreſſion is made, Sounds which are now low could not have been heard at all. If the Auditory Nerve had, like the *Retina*, been expanded into a large Web which had covered or lined ſome wide Cavity, the Impreſſions of Sounds even in this Caſe had been much weaker than they are now: For this large Cavity had given room to the Sounds to dilate, and all Sounds grow weaker as they dilate. Both theſe Inconveniencies are prevented by the preſent Structure of the *Labyrinth* and *Cochlea*, whoſe Canals, by their winding, contain large Portions of the Auditory Nerve, upon every Point of which the ſmalleſt Sound, being at once impreſſed, becomes audible; and by their Narrowneſs the Sounds are hindered from dilating, and the Impreſſions made upon the Nerve by the firſt Dilatations, which are always the ſtrongeſt. The Strength of the Impreſſion in narrow Channels is likewiſe increaſed upon the Account of the Elaſticity of the Sides of the bony Channel; which receiving the firſt and ſtrongeſt Impulſes of the Air, do reverberate them more ſtrongly upon the Auditory Nerve.

SECT. VI.

Of the Noſe.

THE *Noſe* may be divided into two Parts: The external and internal. The external Part is covered with the Skin and ſome Muſcles, of which afterwards. Its upper Part conſiſts of two Bones cloſly joined together on their upper Side. Its lower Part is made of four Cartilages, of which the firſt two are fixed to the lower Ends of the aforeſaid Bones: They are alſo joined together on the upper Side; they are pretty broad, and, as they approach the Tip of the Noſe, they grow thinner and ſofter. The other two ly upon the lower Ends of the firſt two, to which they are tied by a Membrane; they are called *Narium Alæ.*

The Cavity made by theſe Bones and four Cartilages, is divided in its Middle into two Noſtrils, by a Partition, of which the upper End is bony, the lower End Cartilaginous. The fleſhy Extremity of this Cartilage is called *Columna.*

The upper End of each Side of this Cavity divides into two, of which one goes up to the *Os Spongioſum*, the other goes down into the *Fauces*, and opens behind the Palate, by which means we breathe through our Noſtrils.

ſtrils. At the lower End of this Cavity there are two ſmall Holes, which pierce the Bone of the Palate, and open in one behind the *Dentes Inciſivi*; they carry the thin Rheum of the Noſtrils into the Mouth.

The Cavity is covered by a pretty thick and glandulous Membrane; its Glands ſeparate that Matter which we call *Mucus* into the Noſtrils. On the lower End of this Membrane there grow ſeveral Hairs called *Vibriſſi*; they, with the *Mucus*, which the Glands ſeparate, ſtop any Filth from aſcending too far into the Noſtrils.

By the internal Part of the Noſe we underſtand the immediate Organ of Smelling, it lies in the upper Part of the Cavity of the Noſtrils; it is made of the *Os Cribriforme*, and its Productions, the *Os Spongioſum*, of which each *Lamina* is covered with a fine Membrane, upon which the Fibres of the Olfactory Nerves which paſs through the Holes of the *Os Cribriforme*, and the Fibres of the firſt Branch of the fifth Pair which come from the Orbit, are ſpread.

In this Membrane there are many ſmall Glands, which ſeparate an Humour which moiſtens it, and ſtops the Exhalations of odoriferous Bodies, which make their Impreſſion upon the Olfactory Nerves which are ſpread upon it. Hounds and other Beaſts, which have a more exquiſite Smell than Men, have alſo many more *Laminæ* covered with ſuch a Membrane.

Of the Conduits which open in the Noſe.

There are ſeveral Conduits which open between theſe *Laminæ*. The firſt and ſecond are the *Ductus Lacrymalis*, of which we have ſpoken before. The third and fourth come from the *Sinus Frontales.* The fifth and ſixth come from the Nut of the ſecond Bone of the upper Jaw. The ſeventh and eighth come from the Cells of the *Os Spongioſum*; they pierce the Membrane which covers the firſt or uppermoſt *Lamina:* And the ninth and tenth come from the *Sinus* in the *Os Sphænoides.* All theſe Conduits carry the Liquor which is ſeparate in their Cavities into the Noſtrils, for the moiſtning its Membranes, which otherwiſe would dry too much by the Air which we breathe thro' our Noſtrils.

Of the Veſſels of the Noſe.

The Veſſels of the Noſe are Arteries from the Carotidals which paſs with the Olfactory Nerves; they are diſtributed in the internal Noſe: The external, Carotidal and Jugular, and the ſecond Branch of the fifth Pair, give Arteries, Veins and Nerves to the external Noſe. Some give an Account why the Smell of Bodies, which conſiſt of acrimonious Parts, draws Tears from the Eyes; and why the Want of Taſte does ordinarily accompany the Want of Smelling, by the Communication of the Branches of the fifth Pair of Nerves, which are diſtributed thro' theſe three Senſes.

SECT. VII.

Of the Mouth and Tongue.

Of the Lips and Gums.

THE Parts of the Mouth are the Lips, the Gums, the Palate, the *Uvula*, and the ſurrounding Glands.

The Lips are made up of ſeveral Muſcles, of which afterwards. Their Uſe is to ſhut the Mouth, and to articulate the Voice.

The Gums are a hard ſort of Fleſh, formed by the Union of two Membranes, one of which is a Production of the *Perioſteum*, and the other of the internal Membrane of the Mouth; they are ſet about the Teeth, to keep them firm in their Sockets.

Of the Palate.

The Palate or Roof of the Mouth is covered with a pretty thick Membrane, which is continued to the Tonſils; upon it there are a great Number of little Glands, whoſe Excretory Ducts piercing it like a Sieve, diſcharge a Liquor for the moiſtning and diſſolving of the Aliments. It is an Error to think that the Palate taſtes; for by it it is impoſſible to diſtinguiſh the moſt acrid Subſtances.

Of the Uvula and its Muſcles.

The *Uvula* is a Reduplicate or Production of the internal Membrane of the Mouth; its Subſtance is very lax, and it has a Number of ſmall Glands as in the Palate: It is ſomewhat long, of a conick Figure, it hangs from the Roof of the Mouth, at the Extremity of the Paſſage which comes from the Noſe above the *Larynx*, between the Tonſils.

It is moved by two Pair of Muſcles, which are,

The *Pterigoſtaphylinus Externus*; it ariſes fleſhy from a ſmall Protuberance, upon the under Side of the Body of the *Os Sphænoides*, and goes directly to be inſerted into the hind Part of the *Uvula*.

The *Pterigoſtaphylinus Internus* ariſes from the ſame Protuberance of the *Os Sphænoides*, and growing into a ſmall round Tendon, which paſſes over a ſmall Proceſs, like a Hook, of the *Proceſſus Pterigoidæus;* from thence reverting, it is inſerted into the fore Part of the *Uvula.*

When the firſt of theſe Muſcles acteth, it pulleth the *Uvula* backwards; when the ſecond contracteth, it pulleth the *Uvula* forwards; becauſe of the Pully through which its Tendon paſſes, which alters the Direction of its Motion; both which Motions are neceſſary for the articulating the Voice, and in Deglutition, that nothing may regurgitate into the Noſe which we take by the Mouth.

Of the Parotides.

The Glands, which are the Sources of the Spittle, which diſcharges itſelf into the Mouth, are in great Number, of which the principal are the *Parotides,* one on each Side, ſituated under the Ear, above the *Muſculus Maſſeter;* they are of the Conglomerate Sort, being made up of a great Number of ſmaller Glands, each of which ſends out a ſmall Excretory Duct; and they all unite and form one Channel, called *Ductus Salivalis Superior,* which running over the Cheek, pierces the *Buccinator,* and open the Mouth. When the *Maſſeter* acteth in Maſtication, it preſſes the *Saliva* into the Mouth.

Of the Maxillares.

The *Maxillares,* which are ſituated within the under Jaw, one in each Side, are alſo of the Conglomerate Sort; the excretory Pipes of their ſmall Glands unite, and form two Ducts, which both together open under the Tip of the Tongue, on the Inſide of the *Dentes Inciſivi,* where they have each a ſmall *Papilla* at their Orifice. When the Muſcles of the Tongue or lower Jaw act, they compreſs theſe Glands.

Of the Sublinguales.

The *Sublinguales* are one on each Side of the Tongue; they have ſometimes two excretory Ducts, as the former, formed by the Union of that of each ſmall Gland; they run on each Side of the Tongue, near its Tip, where they open into the Mouth, juſt by the former, with which ſometimes they join: Sometimes theſe are wanting, and then each little Gland has a Duct which opens under the Tongue: When the *Mylohyloideus* acteth, it compreſſeth them.

Of the Tonſillæ.

The *Tonſillæ*, or Almonds, are two round Glands placed on the Sides of the Baſis of the Tongue, under the common Membrane of the *Fauces*, with which they are covered; each of them hath a large oval *Sinus* which opens in the *Fauces*, and in it there are a great Number of leſſer ones, which diſcharge themſelves through the great *Sinus*, of a mucous and ſlippery Matter, into the *Fauces*, *Larynx*, and *Oeſophagus*, for the moiſtning and lubricating theſe Parts. When the Muſcle *Oeſophagus* acteth, it compreſſeth the *Tonſillæ*.

Beſides theſe there are a great Number of little Glands ſpread upon the Cheeks and Lips, called *Glandulæ Buccales* and *Labiales*, whoſe Excretory Channels open into the Mouth, and all of them ſeparate a Sort of *Saliva*, or Spittle, which conduces to the Diſſolution of the Aliments.

The Tongue is connected in the Mouth to the *Os Hyoides*, and to the *Larynx*, by a membranous Ligament which is in the Middle of its lower Side. Sometimes the Ligament is continued to the Tip of the Tongue, and then it hindreth Children from ſucking; therefore in ſuch a Caſe it ſhould be cut.

Of the Membranes and Papillæ *of the Tongue.*

The Tongue is covered with two Membranes. The external hath upon its upper Part, and particularly towards the Tip of the Tongue, a great Number of *Papillæ*, of a pyramidal Figure; they ſtand not up ſtraight, but incline towards the Baſis of the Tongue; they appear not ſo plainly in Men as in Brutes, in ſome of which laſt they grow Cartilaginous. Each *Papilla* has a ſmall Root, which makes a ſmall Hole in the viſcous Subſtance, which lies between the two Membranes. In Men, the chief Uſe of theſe *Papillæ Pyramidales* ſeems to be for preſerving the *Papillæ Nervoſæ*, which are of a ſofter Subſtance, that they be not hurt by the Hardneſs, or Roughneſs of the Aliments: And in Beaſts which feed upon Graſs, which they gather together with their Tongue, theſe *Papillæ* are like ſo many Hooks, for the graſping, cutting, and pulling of the Graſs; and perhaps by their Roughneſs rubbing upon the Palate, they conduce to preſs the Spittle out of the Glands. Towards the Baſis of the Tongue are to be ſeen ſeveral ſmall Glands like thoſe of the Cheeks.

Under the external Membrane there lies a thin viſcous Subſtance, which is white on that Side next the external Membrane, and black on that Side next the Internal. When the Tongue is boiled, this Subſtance hardens, and is like a Searce, being full of ſmall Holes made by the Roots of the *Papillæ Pyramidales.*

The internal Membrane is thin and ſoft; upon it there appear ſeveral *Papillæ* made of the Extremities of the Nerves of the Tongue, therefore they are called *Nervoſæ:* They are ſituated upon the Sides of the Tongue, but chiefly towards its Tip; they reſemble the ſmall Horns of a Snail; for the Extremities are round, and bigger than the reſt of their Bodies. The Extremity of each *Papilla* pierces the external Membrane of the Tongue. They quit thoſe Holes, and remain on the internal Membrane, when the external is raiſed. Theſe *Papillæ* are the immediate Organ of Taſting.

The Subſtance of the Tongue is muſculous; being made of Plans of Fibres of different Directions.

The firſt, or external Plan, is made of ſtraight Fibres, which ſurround the Tongue, reaching from its Baſis to its Point: When they contract, they ſhorten the Tonge. Under them there are ſeveral Plans of Fibres, which run from one Edge of the Tongue to the other; they draw the Edges of the Tongue together. There are alſo ſeveral Plans of Fibres, which run from the under to the upper Side of the Tongue; when they contract, they make the Tongue broad and thin. Theſe two ſorts of Fibres ly *Stratum ſuper Stratum,* from the Tip of the Tongue to its Baſis; firſt a Plan of one Sort, and then a Plan of the other Sort. There is ſome Fat betwixt theſe Fibres, but chiefly towards the Baſis of the Tongue.

Its Veſſels. The Veſſels of the Tongue are Veins from the Jugulars, called *Ranulares:* It has Arteries from the Carotidals, and Nerves from the fifth and ninth Pair.

Of its Muſcles. The Muſcles of the Tongue are three Pair.

The *Styloglоſſus;* it ariſes fleſhy from the *Proceſſus Styloides*; from thence deſcending, it is inſerted into the Root of the Tongue. It draws the Tongue upwards.

The ſecond Pair is the *Genioglоſſus;* it ariſes from the Inſide of the fore Part of the lower Jaw, and is inſerted into the Root of the Tongue; it pulls the Tongue out of the Mouth.

The third is the *Ceratoglоſſus;* it ariſes broad and fleſhy from the Sides of the *Os Hyoides*, and is inſerted into the Root of the Tongue; it pulls the Tongue directly into the Mouth. The Fibres of this Muſcle, which are neareſt the Extremities of the *Os Hyoides*, were only called the *Ceratoglоſſus;* and thoſe which were neareſt the Baſis of the *Os Hyoides*, were called the *Baſioglоſſus:* But I ſee no Reaſon to diſtinguiſh them, being they ly in the ſame Plan, and their Fibres have the ſame Direction, Origination, and Inſertion.

Of the Os Hyoides. The Tongue is not only moved by theſe Muſcles, but alſo by a Bone called *Os Hyoides*. Now this Bone lies at the Root of the Tongue: Its Figure is like the *Greek* Letter υ; it is compoſed ordinarily of three Bones. That in the Middle makes its Baſis, it is ſhorter than the other two; it is convex without, but concave within; the other two are joined to its two Ends by two intervening Cartilages; they are much longer than the firſt; they have each a Cartilage at their Extremities, and they are called the *Cornua*, or Horns.

The Baſis of this Bone is joined to the Root of the Tongue; and its Horns are joined to the upper Angles of the *Cartilago Thyroides*, and by two ſmall and round Ligaments to the *Proceſſus Styloides* of each Side. This Bone is moved, and with it the Tongue, by five Pair of Muſcles.

Of its Muſcles.

The firſt is the *Genihoidæus*; it ariſes fleſhy from the fore Part of the lower Jaw internally, and is inſerted into the Baſis of the *Os Hyoides*. It pulls the *Os Hyoides* and the Tongue upwards and forwards.

Its Antagoniſt is the *Sternohyoidæus*; it ariſes from the Inſide of the *Clavicula*, and aſcending above the *Sternothyroidæus* it is inſerted into the Baſis of the *Os Hyoidæus*, which it pulls downwards.

The third is the *Mylohyoidæus*; it ariſeth fleſhy from the Inſide of the lower Jaw, under the *Dentes Molares*, and is implanted into the Sides of the Baſis of the *Os Hyoides*: It draweth this Bone and Tongue obliquely upwards.

Its Antagoniſt is the *Coracohyoidæus*; it is wrong named; for it ariſes not from the *Proceſſus Coracoides*, but from the upper Edge of the *Scapula*, near its Neck, and aſcending obliquely under the *Maſtoidæus*, it is inſerted into the *Os Hyoides*, which it pulls obliquely downwards. The Belly of this Muſcle is a little tendinous in its Middle, that the Veſſels which go to the Head be not compreſſed when it acteth.

The fifth Pair is the *Stylohyoidæus;* it riſes from the *Proceſſus Styloides,* and deſcending obliquely, is inſerted into the Horns of the *Os Hyoides,* which it draws to one Side, and a little upwards.

The Belly of the Muſcle is perforated for the Paſſage of the Tendon in the Middle of the *Digaſtricus.*

A LIST of the different Sorts of Glands in the Body.

1. *Cerebri.*
2. *Plexus Choroidæi.*
3. *Sebaceæ.*
4. *Meatus Auditorii.*
5. *Ciliares.*
6. *Lachrymales.*
7. *Humorem Aqueum*
8. *Cryſtallinum* } *Secernentes.*
9. *Vitreum*
10. *Atrum Choroidis*
11. *Naſales.*
12. *Buccales, Labiales, Palatinæ.*
13. *Parotides, Maxillares, Sublinguales.*
14. *Tonſillarum.*
15. *Oeſophageæ.*
16. *Aſperæ Arteriæ.*
17. *Pericardii.*
18. *Mammarum.*

19. *Ventriculi.*
20. *Inteſtinorum.*
21. *Pancreatis.*
22. *Hepatis.*
23. *Veſicæ Fellis.*
24. *Renum.*
25. *Renales.*
26. *Ureterum.*
27. *Veſicæ Urinariæ.*
28. *Urethræ.*
29. *Teſticulorum.*
30. *Proſtatarum.*
31. *Uteri.*
32. *Vaginæ.*
33. *Lymphaticæ.*
34. *Pinguedinales.*
35. *Medullares.*
36. *Artuum.*
37. *Cutis Milliares.*

All theſe Glands ſeem to me to ſeparate different Humours from the Blood; but if any one ſhall conteſt the Exiſtence of ſome of them, or maintain that ſeveral of them ſeparate the ſame Sort of Humour, I ſhall not diſpute it.

CHAP.

CHAP. V.

Of the Bones.

SECT. I.

Of the Bones in general.

THOUGH, after the Deſcription of the three Cavities, it is uſual to give the Myology; yet becauſe it cannot be underſtood without a perfect Knowledge of the Bones, therefore we ſhall begin with them.

Of the Nouriſhment of the Bones.

The Bones are made up of hard Fibres, tied to one another by ſmall tranſverſe Fibres, as thoſe of the Muſcles are. In a *Fœtus* thoſe Fibres are porous, ſoft, and eaſily diſcerned. It is probable that they are nouriſhed by the Serous or Lymphatick Part of the Blood, which is brought to them by the Arteries, and carried back by the Veins. As their Pores fill with a Subſtance of their own Nature, ſuch as we ſuppoſe the *Lympha* to be, ſo they increaſe, harden, and grow cloſe to one another; but when their Pores are full of this Subſtance, then the Bones are grown to their utmoſt Extent, Hardneſs, and Solidity; their Blood-veſſels, being compreſſed on all Sides by their bony Channels, bring no more Blood than what is ſufficient to ſupply the Places of their decaying Particles.

Of the Uſe of the Marrow.

All the Bones of the Body which have any conſiderable Thickneſs, have either a large

Cavity, or they are ſpongeous, and full of little Cells: In both the one and the other there is an Oleaginous Subſtance called Marrow, contained in proper Veſicles or Membranes, like the Fat. In the large Bones, this fine Oil, by the gentle Heat of the Body, is exhaled through the Pores of its ſmall Bladders, and enters ſome narrow Paſſages, which lead to ſome fine Channels excavated in the Subſtance of the Bone, according to its Length; and from theſe other croſs Paſſages (not directly oppoſite to the former, leſt they ſhould weaken the Bone too much in one Place) carry the Marrow ſtill farther into more longitudinal Channels placed nearer the Surface of the Bone. All this Contrivance is, that the Marrow may ſupple the Fibres of the Bones, and render them leſs apt to break.

All the Bones in the Body, except the Teeth, and where the Bones are articulate to one another, are covered with a thin, but ſtrong and cloſe Membrane, called *Perioſtæum*: It hath an exquiſite Senſe, which gives me Ground to think that it is an Expanſion of ſome of the tendinous Fibres of the Muſcles. Its Uſe is to ſuſtain the Veſſels which enter the Subſtance of the Bones with their Nouriſhment.

Each large Bone is much bigger at his Extremities than in the Middle, that the Articulations might be firm, and the Bones not eaſily put out of Joint: But becauſe the Middle of the Bone ſhould be ſtrong, to ſuſtain the Weight of the Body, and reſiſt Blows and Falls, therefore the Fibres there are cloſely compacted together, ſupporting one another; and the Bone is made hollow, and conſequently not ſo eaſily broken as it muſt have been, had it been ſolid and ſmaller: For of two Bones of equal Length and equal Numbers of Fibres, the Strength of the one will be to the Strength of the other as their Diameters.

Of the Cavities and Protuberances of the Bones.

On the external Surface of the Bones there are ſeveral Cavities and Protuberances. The Cavities are of two Sorts, either narrow and ſhallow, or wide and deep. The firſt Sort is called *Glene;* the ſecond *Cotyle.* But in deſcribing the Bones in particular, we ſhall alſo deſcribe their Cavities. The Protuberances are alſo of two Sorts, *viz. Apophyſis* and *Epiphyſis.* The *Apophyſis* is a Protuberance made by the Fibres of the Bone; an *Epiphyſis* is a Protuberance made by a ſmall Bone ſet upon the Extremity of a bigger Bone, which, as we advance in Age, unite in one. Both the one and the other are ordinarily upon the Extremities of the Bones; and they are either for the Inſertions of Muſcles, whoſe Force they greatly augment, or for the Articulation of the Bones. All their Difference is from their Figure. If it be a large and round Protuberance, it is called *Caput;* and the Part immediately under it *Cervix:* But if it be ſmall and round, then it is called *Condylus.* If it be a ſharp Protuberance, then it is called *Co*[illegible] *Styloides, Coracoides, &c.* according to its Figure.

Analyſis of the Bones.

In the Bones there are much Volatile Salt and Spirit, which are very ſubtile and penetrating; ſome Sulphur which is very ſtinking, a little Phlegm, and much Earth.

SECT. II.

Of the Cartilages and Ligaments in general.

A Cartilage is a ſmooth and ſolid Body, ſofter than a Bone, but harder than a Ligament. In it there are no Cavities nor Cells for containing of Marrow, nor is it covered with any Membrane to make it ſenſible, as the Bones are. The Cartilages have all a natural Reſort, by which, if they are forced from their natural Figure or Situation, they return to it of themſelves, as ſoon as the Force is taken away. They are chiefly in thoſe Places where a ſmall and eaſy Motion is required, as in the Ears, Noſe, *Larynx*, *Trachea*, *Arteria*, and *Sternum*; and their natural Elaſticity ſerves inſtead of Antagoniſt Muſcles. They cover alſo the Ends of all the Bones, which are joined together for Motion. Firſt, becauſe they are ſmoother than the Bones. Secondly, becauſe they are without Senſe. And thirdly, being ſofter than the Bones, the Attrition which is made by the Motion of the Joint is the more eaſily ſupplied.

A Ligament is a white and ſolid Body, ſofter than a Cartilage, but harder than a Membrane; they have no conſpicuous Cavities, neither have they any Senſe, leſt they ſhould always ſuffer upon the Motion of the Joint. Their chief Uſe is to faſten the

Bones, which are articulated for their Motion, together, leſt they ſhould be diſlocated in any violent Motion.

SECT. III.

Of the Articulation of the Bones.

Of the joining of the Bones.

THE Bones are articulated, or joined to one another, either with a manifeſt Motion, or with a ſmall and obſcure Motion, or without any Motion at all. The firſt Sort of Articulation is called *Diarthroſis:* The ſecond, becauſe of the Cartilage by which it is performed, is called *Synchondroſis:* And the laſt *Synarthroſis.*

Of the *Diarthroſis* there are two Sorts, *viz. Enarthroſis* or *Arthrodia*, and *Ginglymus.* The firſt is, when a round Head of a Bone is received into a round Cavity of another, ſuch as the Articulation of the *Femur* with the *Iſchium;* and this Sort of Joining is called, by Tradeſmen, the Ball and Socket. The Property of this Joining is, that the Parts ſo articulated move equally to any Side. The *Ginglymus* is, when a Bone receives and is received; and the Property of this Sort of Articulation is to admit only of the Motions of the Flexion and Extenſion: It is called by Tradeſmen *Charnall*, and it is commonly uſed in *Hinges.* Of this Articulation there are three Sorts. The firſt is, when the End of a Bone has two Protuberances and one Cavity; and the End of the Bone, which is articulated with it, has two Cavities and one Protuberance, as the *Humerus* and the *Ulna*. The ſecond is, when a Bone at one Extremity receives another Bone, and at its other Extremity it is received by the ſame Bone, as the *Radius* and *Ulna*. The third Sort is, when a Bone at one End receives another Bone, and at the other End it is received by a third Bone, as the *Vertebræ* do.

The ſecond Sort of Articulation, which is called *Synchondroſis*, is when the Extremities of the two Bones are joined to one another by means of an interveening Cartilage. Thus the Bodies of the *Vertebræ*, and the Extremities of the Ribs and *Sternum* are joined together, where, though the Motion of all is manifeſt, yet that of any two is hardly diſcernible.

The third Manner of Articulation, called *Synarthroſis*, is of two Sorts, *viz. Sutura* and *Gomphoſis*. The *Sutura* is when two Bones are mutually indented in one another; the Teeth by which they are indented are of various Figures; ſometimes they are like the Teeth of a Saw; ſometimes they are broad at their Extremities, and narrow at their Baſis; ſometimes the Sides of the Teeth are likewiſe indented, and ſometimes there are little Bones between the Teeth, which are alſo indented; theſe are moſt frequently in the *Sutura Lambdoidalis*, and they ſerve as Wedges to keep the Teeth firm. Beſides theſe little Bones there is ordinarily a viſcuous Humour which glews the Indentations together, and which perfectly unites them in ſeveral old Perſons.

This Sort of Articulation is called by Joiners *Dove-tailing*, and is uſed in Drawers, Cabinets, and Boxes. All the Bones of the *Cranium* and upper Jaw, as alſo all the *Epiphyſes* of the Bones, are joined by this Sort of Articulation.

Gomphyſis is when one Bone is faſtned in another, as a Pin or Nail is in a Piece of Wood; and the Teeth only are articulated this Way in their Sockets.

To theſe we may add a third Kind of *Synarthroſis*, very different from any of the former, which is, when a Bone has a long and narrow Channel, which receives a ſmall Proceſs, or the Edge of another Bone; and thus the *Vomer* is articulated to the *Os Sphenoides* and *Septum Narium*: By Tradeſmen this Manner of joining is called *Ploughing*, which we may therefore call Σχινδύλησις. Theſe comprehend all the different Joinings of Bones in the Human Body; therefore I ſhall not mention ſeveral others which we find in Authors to no Purpoſe.

The Extremities of all the Bones that are articular to one another with a manifeſt Motion, are bound together by membranous Ligaments which riſe from the Conjunction of the *Epiphyſis* with the Bone; and preſſing over the Articulation, are inſerted at the Place in the other Bone. Thus they form a Bag, which embraces all that Part of the Extremities of both Bones which play upon one another, and in this Bag is contained a Mucilage for the eaſier Motion of the Joint; this Mucilage is ſeparated by ſome Glands which ly in ſome Fat on the Inſide of the Ligaments. Theſe Bones which are articulated by a *Ginglymus* have the Ligaments much ſtronger on their Sides than they are either before or behind, that the Protuberances may be kept to play true in their Cavities; for if they might ſlip the leaſt to either Side, the Bones would be frequently out of Joint.

SECT. IV.

Of the Bones of the Cranium.

THE *Cranium* or Skull is made up of ſeveral Pieces, which being joined together, form a conſiderable Cavity, which contains the Brains, as in a Box.

The Bigneſs of the *Cranium* is proportionate to the Bigneſs of the Brain. Its Figure is round, a little depreſſed on its Sides. A round Figure being the moſt capacious, was fitteſt to contain a great Quantity of Brains: And the Flatneſs of its Sides helps to enlarge the Sight and Hearing.

Each Bone in the *Cranium* is made up of two Tables or *Laminæ*, between which there is a thin and ſpongeous Subſtance, made of ſome bony Fibres, which come from each *Lamina*, called in *Greek Diploe*, in *Latin Meditullium*.

In it there are a great Number of Veins and Arteries, which bring Blood for the Nouriſhment of the Bones. The Tables are hard and ſolid, becauſe in them the Fibres of the Bones are cloſe to one another. The *Diploe* is ſoft, becauſe the bony Fibres are at a greater Diſtance from one another. By this Contrivance the *Cranium* is not only made lighter, but alſo leſs ſubject to be broken.

The external *Lamina* is ſmooth, and covered with the *Pericranium*. The internal is likewiſe ſmooth; but on it there are ſeveral Furrows made by the Pulſe of the Arteries of the *Dura Mater*, whilſt the *Cranium* was ſoft and yielding.

Of the Suturæ Coronalis, Lambdoidalis, Sagittalis, *and* Squamoſa.

The Bones of the *Cranium* are joined to one another by four Sutures. The firſt is called the *Coronalis*. It reaches tranſverſly from one Temple to the other; it joins the *Os Frontis* with the *Oſſa Parietalia*. The ſecond is called *Lamboidalis*, becauſe it reſembles the *Greek* Letter (λ) *Lambda*; it joins the *Os Occipitis* to the *Oſſa Parietalia* and *Petroſa*. The third is called *Sagittalis*; it begins at the Top of the *Lambdoidalis*, and runs ſtraight to the Middle of the *Coronalis*; it joins the two *Oſſa Parietalia* together. The fourth is called *Sutura Squamoſa*, becauſe the Parts of theſe Bones which are joined by this Suture, are, as it were, cut ſlope-ways, and lapp'd over one another.

This Suture joins the ſemi-circular Circumference of the *Oſſa Temporum* to the *Sphenoides Occipitis*, and to the *Parietalia*. The firſt three Sutures were called *Suturæ Veræ*; and the laſt *Sutura Falſa*, becauſe it was ſuppoſed to have no Indentations, which is falſe.

Of the Sutura Tranſverſalis, Ethmoidalis *and* Sphænoidalis.

The Bones of the *Cranium* are not only joined to one another, but they are alſo joined to the Bones of the upper Jaw by three other Sutures. The firſt is the *Tranſverſalis*, it runs acroſs the Face; it paſſes from the little Angle of the Eye down to the Bottom of the Orbit, and up again by the great Angle of the Eye over the Root of the Noſe; and ſo to the little Angle of the other Eye. It joins the *Os Frontis* to the Bones of the upper Jaw. The ſecond is the *Ethmoidales*; it ſurrounds the Bone of that Name, and joins it to the Bones which are about it. The third is the *Os Sphænoidales*; it ſurrounds the *Os Sphænoides*, joins it to the *Os Occipitis*, the *Oſſa Petroſa*, and to the *Os Frontis*.

The *Cranium* is made of ſeveral Pieces joined together by its Sutures, that it might be the ſtronger, and leſs apt to break, that ſeveral Membranes and Veſſels which ſuſpend the *Dura Mater*, and which go to the *Pericranium*, may paſs through the Sutures, and that the Matter of Tranſpiration may paſs through them.

Of the Bones of the Skull. Now the Bones of the *Cranium* are ſix proper, and two common to it and the upper Jaw. The ſix proper are, the *Os Frontis*, which makes the fore Part of the Skull; the *Os Occipitis*, which makes the hind Part; and the *Oſſa Parietalia* and *Temporum*, which make the Sides. The two common are, the *Sphænoides* and the *Os Ethmoides*, which are Part of the Baſis of the Skull.

Os Frontis. The firſt of the proper is the *Os Frontis* or *Coronale*; it is almoſt round; it joins the Bones of the *Sinciput* and Temples, by the Coronal Suture, and the Bones of the upper Jaw by the *Sutura Tranſverſalis*, and the *Os Sphænoides* by the *Sutura Sphænoidalis*. It forms the upper Part of the Orbit, and it has four *Apophyſes* which are at the four Angles of the two Orbits. It has two Holes above the Orbits, through which paſs a Vein, Artery, and ſome Twigs of the firſt Branch of the fifth Pair of Nerves. It has alſo one in each Orbit, a little above the *Os Planum*, through which a Twig of the Ophthalmick Branch of the fifth Pair paſſes to the Noſe; it is the *Orbiter Internus*. It has two *Sinus's* above the Eye-brows, between its two Tables; they are lined with a thin Membrane, in which there are ſeveral Blood-veſſels and Glands, which ſeparate a mucous Serioſity, which falls into the Noſtrils. The Inſide of this Bone has ſeveral Inequalities, made by the Veſſels of the *Dura Mater*. It has two large Dimples made by the anterior Lobes of the Brain. Above the *Criſta Galli* it has a ſmall blind Hole, into which the End of the *Sinus Longitudinalis* is inſerted. From this Hole it has a pretty large Spine which runs up along its Middle; inſtead of this Spine, there is ſometimes a *Sinus*, in which lies the *Sinus Longitudinalis*, which ought to be obſerved carefully by Surgeons in Wounds in this Place. This Bone is thicker than the *Sinciput* Bones, but thinner than the *Os Occipitis*. In Children it is always divided in its Middle by a true Suture.

Oſſa Parietalia.

The ſecond and third are the Bones of the *Sinciput* called *Parietalia*; they are the thinneſt Bones of the *Cranium*; they are almoſt ſquare, and ſomewhat long; they are joined to the *Os Frontis* by the *Sutura Coronalis*, to one another in the Crown of the Head by the *Sutura Sagittalis*, to the *Os Occipitis* by the *Lambdoidalis*, and to the *Oſſa Temporum* by the *Suturæ Squamoſæ*. They are ſmooth and equal on their Outſide, but on their Inſide they have ſeveral Furrows made by the Pulſe of the Arteries of the *Dura Mater*. They have each a ſmall Hole near the *Sutura Sagittalis*, through which there paſs ſome Veins which carry the Blood from the Teguments to the *Sinus Longitudinalis*.

Oſſa Temporum. The fifth and ſixth are the *Oſſa Temporum*, ſituated in the lower Part of the Sides of the *Cranium*; their upper Part, which is thin, conſiſting only of one Table, is of a circular Figure, and is joined to the *Oſſa Parietalia* by the *Suturæ Squamoſæ*: Their lower Part, which is thick, hard, and unequal, is joined to the *Os Occipitis*, and to the *Os Sphænoides*; this Part is called *Os Petroſum*. They have each three external *Apophyſes* or Proceſſes, and one internal. The firſt of the external is the *Proceſſus Zygomaticus*, which runs forwards and unites with the Proceſs of the *Os Mali*, making that Bridge called the *Zygoma*, under which lies the Tendon of the Crotaphite Muſcle. The ſecond is the *Mamillaris*, or *Maſtoidæus*; it is ſhort and thick, ſituated behind the *Meatus Auditorius*. The third is the *Proceſſus Styliformis*, which is long and ſmall; to it the Horns of the *Os Hyoides* are tied. The internal Proceſs is pretty long and big in the Baſis of the Skull; it contains all the Cavities and little Bones of the Ear, which have been already deſcribed. The Holes in the Temporal Bones are two internal, and four external. The firſt of the internal is the Hole through which the Auditory ry Nerve paſſes; the ſecond is common to it and the *Os Occipitis:* The eighth Pair of Nerves, and the Lateral *Sinus*'s paſs through it. The firſt of the external Holes is the *Meatus Auditorius Externus.* The ſecond opens behind the Palate; it is the End of that Paſſage which comes from the Barrel of the Ear to the Mouth. The third is the Orifice of the Conduit by which the Carotidal Arteries enter the *Cranium:* And the fourth is behind the *Proceſſus Maſtoidæus;* by it paſſes a Vein which carries the Blood from the external Teguments to the Lateral *Sinus*'s. Sometimes this Hole is wanting; there is another which is between the *Proceſſus Maſtoidæus* and the *Styliformis,* through which the *Portio Dura* of the Auditory Nerve paſſes. They have each a *Sinus* lined with a Cartilage under the *Meatus Auditorius,* which receives the Condyle of the lower Jaw.

The ſixth Bone of the *Cranium* is the *Os Occipitis;* it lies in the hinder Part of the Head; it is almoſt like a Lozenge with its lower Angle turned inwards; it joins the *Oſſa Parietalia* and *Petroſa* by the *Sutura Lambdoidalis,* and the *Os Sphœnoides* by the *Sphœnoidalis.* It is thicker than any of the other Bones of the *Cranium* yet it is very thin where the *Splenius, Complexus,* and *Trapezus* are inſerted. Externally it is rough, internally it has two *Sinus*'s, in which ly the two Protuberances of the *Cerebellum,* and two large Furrows in which lies the *Sinus Lateralis.* It has ſeven Holes; the firſt two are common to it, and the *Oſſa Petroſa;* the Lateral *Sinus*'s and the *Par Vagum* **Os Occipitis.**

paſs through them. The third is the great Hole thro' which the *Medulla Spinalis* paſſes. The fourth and fifth are the Holes through which the ninth Pair of Nerves paſs. The ſixth and ſeventh are two Holes, through which there paſs two *Veins* which bring the Blood from the external *Teguments* to the *Sinus Lateralis*; ſometimes there is but one, and ſometimes none of theſe two; there are ſometimes two more, through which the Vertebral Veins paſs. This Bone has alſo two *Apophyſes*, one on each Side of the great Hole; they are lined with a Cartilage, and articulated with the firſt *Vertebra* of the Neck. It has alſo a Protuberance in its Middle, from which there goes a ſmall Ligament, which is inſerted into the firſt *Vertebra* of the Neck. It is longer in Beaſts than in Men.

Os Splænoides.

The firſt of the Bones common to the Skull and upper Jaw is the *Sphænoides*. It is a Bone of a very irregular Figure. It is ſituated in the Middle of the Baſis of the Skull. It is joined to all the Bones of the *Cranium* by the *Sutura Sphænoidalis*, except in the Middle of its Sides, where it is continued to the *Oſſa Petroſa* as they were one Bone. On its Outſide it has five *Apophyſes*. The firſt two are broad and thin like a Bat's Wings, they are called *Pterigoides*; they have each a pretty long *Sinus*, from which the Muſcle called *Pterigoidæi* ariſes; and at their lower End they have each a ſmall Hook like a Proceſs, upon which the *Periſtaphylinus Externus* turns its Tendon. The third and fourth make the internal and lower Part of the Orbit; and the fifth is a little *Apophyſe* like the

Criſti

Criſta Galli in its fore Part, which is received in a Cavity at the further End of the *Vomer*. There is alſo a little ſmall Protuberance in the Middle of this Bone, from which the Muſcles of the *Uvula* ariſe. On its Inſide it has four Proceſſes called *Clinoides*, they form a Cavity in the Middle of this Bone called *Cella Turcica*; in which lies the *Glandula Pituitaria*. Betwixt the two Tables of this Bone, under the *Cella Turcica*, there is a *Sinus*, divided in two in its Middle, which opens by two Holes into the Cavity of the Noſtrils. In the *Os Sphænoides* there are twelve Holes. By the firſt and ſecond paſs the Optick Nerves; by the third and fourth, which are called *Foramina Lacera*, paſs the third Pair, fourth Pair, firſt Branch of the fifth Pair, and the ſixth Pair; by the fifth and ſixth paſs the ſecond Branch of the fifth Pair; by the ſeventh and eighth paſs the third Branch of the ſame Pair; the ninth and tenth enter the Arteries of the *Dura Mater*; and by the eleventh and twelfth enter the internal Carotidals, and the intercoſtal Nerve goes out. The Canals by which the Carotidals enter are oblique; the Beginning of them is made in the *Oſſa Petroſa*, and they open within the Skull in the *Sphænoides*.

Os Ethmoides.

The ſecond and laſt of the common Bones is the *Os Ethmoides*, ſituated in the Middle of the Baſis of the *Os Frontis*, joined to that Bone and to the *Os Sphænoides* by the *Sutura Ethmoidalis*. In its Middle it has a ſmall Proceſs called *Criſta Galli*, to which the fore End of the *Falx* is tied. This Bone is perforated by a Number of ſmall Holes through which the Fibres of the Olfactory Nerves paſs, therefore it is alſo called *Os Cribriforme.* From its under Side there goes a thin Bone, which divides the Cavity of the Noſtrils in two; the lower Edge of this Bone is grooved with the *Vomer*. On each Side of this Partition it has ſeveral thin ſpongious *Laminæ*, called *Oſſa Spongioſa*; they are full of little Cells, where they are joined to the *Ethmoides*. There are two *Laminæ*, which neither adhere to the *Os Ethmoides*, nor to the other *Laminæ*, but only by the Membrane which covers them all. The two external *Laminæ* of the *Oſſa Spongioſa*, make Part of the Orbit at the great *Canthus*; and they are called *Oſſa Plana*, becauſe they are ſmooth and even.

SECT. V.

Of the Bones of the upper Jaw.

THE Bones of the upper Jaw are two, common to it and the Skull, which have been already deſcribed; and eleven proper, that is, five in each Side, and one in the Middle: They are joined to the Bones of the Skull by the three common Sutures, and joined to one another by a fine but true Suture.

Os Mali. The firſt of the proper Bones is the *Os Mali* or *Zygoma*; it is of a triangular Figure. Its upper Side makes the lower and external Part of the Circumference of the Orbit, where it joins the *Os Sphænoides*. Its internal Side joins the *Os Maxillare*. Its external has a long Proceſs, which joining that of the *Oſſa Temporum*, forms the *Proceſſus Zygomaticus*; it joins the *Os Frontis* at the little Angle of the Eye. It is concave within, and it ſticks out a little forwards, making the higheſt Part of the Cheek.

Os Maxillare. The ſecond is the *Os Maximum*, or *Maxillare*, becauſe in it all the Teeth of the upper Jaw are ſet. It is of a very irregular Figure. On its Outſide it joins the *Os Mali*. Its upper Side makes the lower and internal Part or Circumference of the Orbit. At its great *Canthus* it joins the *Os Unguis* and *Frontis*. The lower Side of the *Os Naſi* is joined to it. Under the upper Lip it joins with its Fellow of the other Side, and both joined together make the fore and greateſt Part of the Roof of the Mouth. It is very thin, and between its two *Laminæ* it has a large Cavity which opens by a ſmall Hole into the Noſtrils. In its lower End it has ſixteen *Sinus*'s or Sockets, in which the Teeth are ſet. It has a ſmall Hole called *Orbiter Externus*, in that Part of it which makes Part of the Orbit, through which the Nerves of the fifth Pair, which come from the Teeth, paſs. Behind the *Dentes Inciſivi*, where it joins with its Fellow, it has another which comes from the Noſtrils.

Os Unguis. The third is the *Os Unguis*, it is a little thin Bone which lies in the great Angle of the Orbit, it has a Hole in which the Lachrymal Sack lies. I ſee no Reaſon why this Bone ſhould be counted a Bone of the upper Jaw, ſeeing it lies entirely in the great Angle

gle of the Orbit; there is more Reaſon to count it a *Lamina* of the *Os Spongioſum*, than the *Os Planum*,

The fourth is the *Os Naſi*; this is a thin but ſolid Bone, which makes the upper Part of the Noſe; its upper End is joined to the *Os Frontis* by the *Sutura Tranſverſalis:* One of its Sides joins its Fellow, where they are ſupported by the *Septum Narium*. Its other Side joins the *Os Maxillare*. Upon its lower End the Cartilages of the Noſtrils are faſtned. Externally it is ſmooth, but internally it is rough.

Os Palati. The fifth Bone of the upper Jaw is the *Os Palati;* it is a ſmall Bone almoſt ſquare, it makes the poſterior Part of the Roof of the Mouth. It is joined to that Part of the *Os Maxillare* which makes the Fore Part of the Palate. It is alſo joined to its Fellow, and to the *Proceſſus Pterigoidæus*. It has a ſmall Hole through which a Branch of the fifth Pair of Nerves goes to the Membrane of the Palate.

The eleventh and laſt is called the *Vomer*, it is ſituated in the Middle of the lower Part of the Noſe. It has a Cleſt in its upper Side, in which Cleſt it receives the lower Edge of the *Septum Naſi*. In its further End it receives a ſmall *Apophyſe* of the *Os Sphænoides*, and its under Side joins the *Os Palati*.

By what has been ſaid, you ſee, that the Bones of the Skull and upper Jaw compoſe the Orbit of the Eye. The upper Part of it is made of the *Os Frontis;* the *Os Unguis* and *Os Planum* make the inner and lower Part of the great Angle; and the *Os Sphænoides*

noides the inner and lower of the little Angle. The *Os Maxillare* makes the inner and lower Part of the Circumference, and the *Os Mali* the outer and lower Part.

Let us now briefly recapitulate all the Holes in the Head. They are either external or internal. The external Holes are, 1. The two in the Coronal Bone above the Orbit, through which a Vein, Artery, and a Nerve from the Ophthalmick Branch of the fifth Pair paſs, for the Brow and frontal Muſcle; this frequently appears only as a Notch. 2. The *Orbiter Internus* in the ſame Bone within the Orbit, a little above the *Os Planum*, for another Branch of the fifth Pair of Nerves which go to the Noſe. 3. Is between the *Os Unguis* and the *Os Maxillare*, in the great *Canthus*, through which the *Ductus Lachrymalis* paſſes to the Noſe. 4. *Orbiter Externus* in the *Os Maxillare* below the Orbit through which the Nerves and Veſſels which come from the Teeth paſs to the Cheek. 5. One ſingle Hole in the ſame Bone behind the fore Teeth, which comes from the Noſe. 6. Two in the *Oſſa Palati*, through which a Branch of the fifth Pair of Nerves paſſes to the Palate, *Uvula*, and Gums. 7. In the Temporal Bone between the *Proceſſus Maſtoidæus* and *Styliformis*, through which the *Portio Dura* of the Auditory Nerve paſſes. 8. The *Ductus Auditorius Externus*. 9. The *Ductus Auditorius Internus*. 10. The Conduit for the Carotidal Artery. 11. In the ſame Bone through which a Vein paſſes from the external Teguments to the Lateral *Sinus*'s; this is behind the *Proceſſus Maſtoidæus*.

dæus. 12. In the Occipital Bone behind its *Apophyſe*, through which the Vertebral Veins paſs. 13. In the ſame Bone for a Branch of the external Jugular. 14. One ſingle large Hole for the *Medulla Spinalis*.

The internal Holes are, 1. The blind Holes above the *Criſta Galli*. 2. The Holes in the *Os Ethmoides*. 3. In the *Os Sphænoides* for the Optick Nerves. 4. The *Foramen Lacerum*, through which the third, fourth, firſt Branch of the fifth, and ſixth Pair of Nerves paſs. 5. For the ſecond Branch of the fifth Pair of Nerves. 6. For the third Branch of the ſame Nerve. 7. The *Foramen Arteriæ Duræ Matris*. 8. The Canal through which the Carotidal enters, and the Intercoſtal paſſes out; but this we counted among the external Holes. 9. In the *Proceſs* of the *Os Temporum*, through which the Auditory Nerve paſſes. 10. Between the Temporal and Occipital Bones, it is divided in two by the *Dura Mater*; through the one Part paſſes the eighth Pair of Nerves, and the *Nervus Acceſſorius*; through the other the Lateral *Sinus*'s open into the internal Jugulars. 11. One in each Side of the large Hole of the *Occiput*, through which the ninth Pair of Nerves go out.

SECT. VI.

Of the lower Jaw.

THE lower Jaw is made of one Bone whoſe Fibres at the Chin, in Children,

dren, do not oſſify till they are about two Years old. It is compoſed of two Tables, which are pretty hard and ſmooth; but betwixt theſe two *Laminæ* it is porous, and full of little Cavities: Its Figure reſembles the Letter *v*; at each Extremity it has two Proceſſes; the uppermoſt is called *Corona*; it is thin and broad at its Beginning, but it ends in a ſharp Point, which paſſing under the *Proceſſus Zygomaticus*, has the Tendon of the Crotaphite Muſcle inſerted into it. The other, which is ſhorter and lower, has a round Head, lined with a Cartilage, which is articulated into the *Sinus* of the *Os Petroſum*; but betwixt the Cartilage which lines the *Sinus*, and that which covers the Head of this Proceſs, there is a third, which adheres to the *Ligamentum Annulare*, which ſurrounds this Articulation. The Motion of the Jaw ſideways, which is abſolutely neceſſary in chewing, is much facilitated by this looſe intervening Cartilage. The lower Edge of this Jaw is called its Baſis, each End of which is called the Angle of the lower Jaw.

The lower Jaw has four Holes, two on its Inſide near its Proceſſes, and two on its Outſide near its Middle. By the internal Holes enter a Branch of the fifth Pair of Nerves, an Artery from the Carotidals, a Vein paſſes out to the Jugulars, their Branches are ſpread in the Roots of the Teeth. By the external Holes theſe ſame Veſſels paſs, and are diſtributed upon the Chin. It has alſo ſixteen *Sinus*'s into which the Teeth are ſet.

SECT. VII.

Of the Teeth.

Of the Subſtance of the Teeth.

THE Teeth are the hardeſt and ſmootheſt Bones of the Body; they are formed in the Cavities of the Jaws, which are lined with a thin Membrane, upon which there are ſeveral Veſſels, through which there paſſes a thick, viſcous, tranſparent Humour, which, as it increaſes, hardens in the Form of Teeth, which, about the ſeventh or eighth Month after Birth, begin to pierce the Edge of the Jaw, tear the *Perioſtæum* and Gums; which, being very ſenſible, create a violent Pain, and other Symptoms incident to Children, in the Time of Toothing.

The Teeth begin not to appear all at one Time: Firſt the *Dentes Inciſivi* of the upper, and then thoſe of the lower Jaw appear, becauſe they are the thinneſt and ſharpeſt. After them come out the *Canini*, becauſe they are ſharper than the *Molares*, but thicker than the *Inciſivi*; and laſt of all the *Molares*, becauſe they are the thickeſt and blunteſt. Of this viſcous tranſparent Liquor, which is the Subſtance of the Teeth, there are two Lays, the one below the other, divided by the ſame Membrane, which covers all the Cavity of the Jaw: The uppermoſt Lay forms the Teeth, which come out firſt; but about the ſeventh Year of Age they are thruſt out by the Teeth made of the undermoſt Lay, which then begin to ſprout; and if theſe Teeth be loſt, they never grow again; but if ſome have been obſerved to ſhed their Teeth twice, they have had three Lays of this viſcous Humour. About the one and twentieth Year the two laſt of the *Molares* ſpring up, and they are called *Dentes Sapientiæ*.

Of the Dentes Inciſivi. The Teeth, which are ſometimes fourteen, ſometimes fifteen, and ſometimes ſixteen in each Jaw, are of three Sorts, the *Dentes Inciſivi, Canini*, and *Molares*. The *Inciſivi* are the four foremoſt Teeth in each Jaw; they are pretty broad, ſharp at their Ends, a little convex outwards and hollow inwards; they have each a pretty long Root, which is a little crooked, and which grows ſmall towards its Extremity, that the Preſſure might not be all directly upon one Point of the Jaw, but ſuſtained equally by every Part which the Sides of the Root touch.

Canini. The *Canini* are two in each Jaw, one on each Side of the *Inciſivi*; they are pretty thick and round, and they end in a ſharp Point; they have each one Root, which is longer than the Roots of the *Inciſivi*; their proper Uſe is to pierce the Aliments, becauſe the fore Teeth are not only apt to be pulled outwards by the Things we hold and break with them, but likewiſe becauſe they are more ſubject to Blows than the *Molares*; therefore above two thirds of them are contained in their *Alveoli* or Sockets, by which their Reſiſtance of all lateral Preſſures is much greater than that of the *Molares*.

Molares. The *Molares* ordinarily are ten in each

Jaw; they are the thickeſt and biggeſt of the Teeth, their Extremities are broad and uneven; and becauſe the Preſſure upon them is generally perpendicular, therefore they have ſometimes two, ſometimes three, and ſometimes four Roots, which ſeparate a little from one another, that, having a broad Baſis, they may find the greater Reſiſtance from the Jaw when they preſs upon one another in chewing of the Aliments; and the Preſſure has the leſs Force, ſeeing the Roots are a little crooked outwards, and not in a ſtrait Line under the Preſſure. The laſt of the *Molares* are the biggeſt and hardeſt, becauſe we ordinarily thruſt the hardeſt Bodies fartheſt into our Mouth; they are nigheſt the Articulation, because their Uſe, which is to grind the Aliments ſmall, requires the greateſt Strength. The Roots of the Teeth of the upper Jaw are all ſomewhat larger than thoſe of the under Jaw, becauſe the upper Jaw is not ſo ſtrong to reſiſt the Preſſure of the Teeth as the lower is.

SECT. VIII.

Of the Spine *and* Vertebræ.

***The Number of the* Vertebræ.**

BY the *Spine*, we underſtand that Chain of Bones which reaches from the firſt *Vertebræ* of the Neck to the *Os Coccygis*; they are twenty-four in Number, beſides thoſe of the *Os Sacrum*, ſeven *Vertebræ* of the Neck, twelve of the Back, and five of the Loins; they ly not in a ſtrait Line, for thoſe of the Neck bend inwards, thoſe of the Back outwards, for enlarging the Cavity of the *Thorax*; thoſe of the Loins bend inwards again, and thoſe of the *Os Sacrum* outwards, to enlarge the Cavity of the Baſon.

The Parts of the Vertebræ.

In each *Vertebra* we diſtinguiſh two Parts, the Body of the *Vertebra*, and its Proceſſes; the Body is ſofter and more ſpongeous than the Proceſſes, which are harder and more ſolid. The fore Part of the Body is round and convex, the hind Part ſomewhat concave; its upper and lower Side are plain, each covered with a Cartilage, which is pretty thick forwards, but thin backwards, by which Means we bend our Body forwards; for the Cartilages yield to the Preſſure of the Bodies of the *Vertebræ*, which in that Motion come cloſer to one another. This could not be effected, if the harder Bodies of the *Vertebræ* were cloſe to one another. Each *Vertebra* has three Sorts of Proceſſes towards its hinder Part, two tranſverſe or lateral, one on each Side; they are nearer the Body of the *Vertebræ* than the reſt. In each of them there is a Tendon of the Vertebral Muſcles inſerted. Four oblique Proceſſes, two on the upper Part, and two on the lower; by theſe the *Vertebræ* are articulated to one another; and one acute on the hindermoſt Part of the *Vertebra*.

Theſe Proceſſes, with the hinder or concave Part of the Body of the *Vertebræ*, form a large Hole in each *Vertebra*: And all the Holes anſwering one another, make a Channel for the Deſcent of the Spinal Marrow, which ſends out its Nerves to the ſeveral Parts of the Body by Pairs, through two ſmall Holes formed by the jointing of four Notches in the Sides of each ſuperior and inferior *Vertebra*.

Of the Articulation of the Vertebræ.

The *Vertebræ* are articulated to one another by a *Ginglymus*; for the two deſcending oblique Proceſſes of each ſuperior *Vertebra* of the Neck and Back have a little Dimple in their Extremities, wherein they receive the Extremities of the two aſcending oblique Proceſſes of the inferior *Vertebræ*; ſo that the two aſcending Proceſſes of each *Vertebra* of the Neck and Back are received, and the two deſcending do receive, except the firſt of the Neck, and laſt of the Back; but the aſcending Proceſſes of each *Vertebra* of the Loins receive, and the two deſcending are received, contrary to thoſe of the Neck and Back.

The *Vertebræ* are all tied together by a hard Membrane made of ſtrong and large Fibres: It covers the Body of all the *Vertebræ* forwards, reaching from the firſt of the Neck to the *Os Sacrum*: There is another Membrane which lines the Canal, made by the large Hole of each *Vertebra*, which alſo ties them all together. Beſides, the Bodies of each *Vertebra* are tied to one another by the intervening Cartilages and the Tendons of the Muſcles, which are inſerted in their Proceſſes, and ty them together behind.

This Structure of the *Spine* is the very beſt that can be contrived; for, had it been all one Bone, we could have had no Motion in our Backs; had it been of two or three Bones articulated for Motion, the *Medulla Spinalis* muſt have been neceſſarily bruiſed at every Angle or Joint; beſides, the whole would not have been ſo pliable for the ſeveral Poſtures we have Occaſion to put ourſelves in. If it had been made of ſeveral Bones without intervening Cartilages, we ſhould have had no more Uſe of it, than if it had been but one Bone. If each *Vertebra* had had its own diſtinct Cartilages, it might have been eaſily diſlocated. And laſtly, the oblique Proceſſes of each ſuperior and inferior *Vertebra* keep the middle one, that it can neither be thruſt backwards nor forwards to compreſs the *Medulla Spinalis.*

Thus much of the *Vertebræ* in general; but becauſe they are not all alike, we ſhall therefore deſcend to a more particular Examination.

Of the Vertebræ *of the* Neck.

The ſeven *Vertebræ* of the Neck differ from the reſt in this, That they are ſmaller and harder. Secondly, That their tranſverſe Proceſſes are perforated for the Paſſage of the Vertebral Veſſels. Thirdly, That their acute Proceſſes are forked and ſtrait; but, beſides this, the firſt and ſecond have ſomething peculiar to themſelves.

Atlas.

The firſt, which is called *Atlas,* is tied to the Head, and moves with it upon the ſecond ſemicircularly; its aſcending oblique Proceſſes receive the Tubercles of the *Occiput,* upon which Articulation the Head is only moved forwards and backwards; and its deſcending Proceſſes receive the aſcending Proceſſes of the ſecond *Vertebra.* It has no acute Proceſs, that it might not hurt the Action of the *Muſculi Recti;* but a ſmall Tubercle, to which the ſmall Ligament of the Head is inſerted. In the fore Part of its great Hole it has a pretty large *Sinus*, in which lies the Tooth-like Proceſs of the ſecond *Vertebra*, being faſten'd by a Ligament that riſes from each Side of the *Sinus*, that it compreſs not the *Medulla Spinalis*. It has two ſmall *Sinus*'s in its upper Part, in which the tenth Pair of Nerves and the Vertebral Arteries ly.

Epiſtrophæus. The ſecond is called *Epiſtrophæus*, or *Vertebra Dentata*; in the Middle between its two oblique aſcending Proceſſes, it has a long and round Proceſs like a Tooth, which is received into the foreſaid *Sinus*; upon it the Head with the firſt *Vertebra* turns half round as upon an Axis. The Extremity of this Proceſs is knit to the *Occiput* by a ſmall but ſtrong Ligament. A Luxation of this Tooth is mortal, becauſe it compreſſes the *Medulla Spinalis*.

Axis. The third *Vertebra* is called *Axis*; and the four following have no Name, nor any peculiar Difference.

***Of the* Vertebræ *of the* Back.** The twelve *Vertebræ* of the back differ from the reſt in this, that they are larger than thoſe of the Neck, and ſmaller than thoſe of the Loins; their acute Proceſſes ſlope downwards upon one another: They have in each Side of their Bodies a ſmall Dimple wherein they receive the round Extremities of the Ribs, and another in their tranſverſe Proceſſes which receives the little Tubercle near that Extremity of the Ribs. The Articulation of the twelfth with the firſt of the Loins is by *Arthrodia*, for both its aſcending and deſcending oblique Proceſſes are received.

Of the Vertebræ of the Loins.

The five *Vertebræ* of the Loins differ from the reſt in this, that they are the broadeſt, and the laſt of them is the largeſt of all the *Vertebræ*. Their acute Proceſſes are broader, ſhorter, and wider from one another, their tranſverſe longer, to ſupport the Bowels, and the Muſcles of the Back; they are not perforated as thoſe of the Neck, nor have they a Dimple or *Sinus* as thoſe of the Back. The Cartilages which are betwixt their Bodies are thicker than any of the reſt.

Of the Os Sacrum.

The *Vertebræ* of the *Os Sacrum* grow ſo cloſe together in Adults, as that they make but one large and ſolid Bone, of the Figure of an *Iſoſceles* Triangle, whoſe Baſis is tied to the laſt *Vertebra* of the Loins, and the upper Part of its Sides to the *Ilia*, and its Point to the *Os Coccigis*. It is concave and ſmooth on its Foreſide, but convex and unequal on its Backſide. It hath five Holes on each Side, but the Nerves paſs only through the five on its Foreſide. Its acute Proceſſes or *Spines* are ſhorter and leſs than thoſe of the Loins, and the lower is always ſhorter than the upper.

Os Coccigis.

The *Os Coccigis* is joined to the Extremity of the *Os Sacrum*; it is compoſed of three or four Bones, of which the lower is ſtill leſſer than the upper, till the laſt ends in a ſmall Cartilage; it reſembles a little Tail turned inwards; its Uſe is to ſuſtain the ſtrait Gut; it yields to the Preſſure of the *Fœtus* in Women in Travail, and Midwives uſe to thruſt it backwards, but ſometimes rudely and violently, which is the Occaſion of great Pain, and of ſeveral bad Effects.

From what has been ſaid, it is eaſy to underſtand how the Motion of the Back is performed: Though each particular *Vertebra* has but a very ſmall Motion, yet the Motion of all is very conſiderable. We have ſaid, that the Head moves only backwards and forwards upon the firſt *Vertebra*, and ſemicircularly upon the ſecond. The ſmall Protuberance which we have remarked in the Bone of the hind Head, falling upon one another in the firſt *Vertebra*, ſtops the Motion of the Head backwards, that it compreſs not the Spinal Marrow; and when the Chin touches the *Sternum*, it can move no farther forwards. The oblique or ſemi-circular Motions are limited by the Ligaments which tie the Proceſs of the ſecond *Vertebra* to the Head, and by thoſe which tie the firſt to the ſecond *Vertebra*. The Motion of the other *Vertebræ* of the Neck is not ſo manifeſt; yet it is greater than that of the *Vertebræ* of the Back, becauſe their acute Proceſſes are ſhort and ſtrait, and the Cartilages which are between their Bodies thicker. The twelve *Vertebræ* of the Back have the leaſt Motion of any, becauſe their Cartilages are thin, their acute Proceſſes are long, and very near to one another; and they are fixed to the Ribs, which neither move forwards nor backwards. But the greateſt Motion of the Back is performed by the *Vertebræ* of the Loins, becauſe their Cartilages are thicker, and their acute Proceſſes are at a greater Diſtance from one another; for the thicker the Cartilages are, the more we may bend our Body forwards; and the greater Diſtance there is betwixt the acute Proceſſes, the more we may bend ourſelves backward.

This is the Structure and Motion of the *Vertebræ*, when they are in their natural Poſition; but we find them alſo in ſeveral Perſons ſeveral Ways diſtorted. If the *Vertebræ* of the Back ſtick out, ſuch as have this Deformity are ſaid to be bunch-back'd; and in ſuch the Cartilages which are between the *Vertebræ* are very thin and hard forwards, but conſiderably thick backwards, where the oblique Proceſſes of the ſuperior and inferior *Vertebræ* are at a conſiderable Diſtance from one another, which Diſtance fills up with a viſcous Subſtance. This Inequality of the Thickneſs of the Cartilages happens either by a Relaxation or Weakneſs of the Ligaments and Muſcles, which are faſtned to the Backſide of the *Vertebræ*, in which Caſe their Antagoniſts finding no Oppoſition, remain in a continual Contraction, and conſequently there can be no Motion in theſe *Vertebræ*. If this Deformity has been from the Womb, then the Bones being at that Time ſoft and tender, the Bodies of the *Vertebræ* partake of the ſame Inequality as the Cartilages. If the Bunch be towards one Shoulder, for Example, towards the right, then the Cartilages on that Side are very thick, but thin and dry on the other Side; on the left Side the oblique *Apophyſes* come cloſe together, but on the right there is a conſiderable Diſtance betwixt them, and the Ligaments and Muſcles are greatly extended on the right Side, but thoſe on the left are as much contracted. If the *Vertebræ* are diſtorted inwards, all Things have a different Face: The Cartilages and ſometimes the *Vertebræ* are very thick forwards, but mighty thin and hard backwards: The acute and oblique Proceſſes are very cloſe to one another, and the Ligaments upon the Bodies of the *Vertebræ* are greatly relaxed; but the Muſcles and Ligaments which tie the Proceſſes together are very much contracted. Theſe Diſtortions ſeldom happen in the *Vertebræ* of the Loins; but ſuch as are ſo miſerable, have little or no Motion of their Back.

SECT. IX.

Of the Oſſa Innominata.

THE *Oſſa Innominata* are two large Bones ſituated on the Sides of the *Os Sacrum*; in a *Fœtus* they may be each ſeparated into three Pieces, which in Adults unite and make but one Bone, in which they diſtinguiſh three Parts. The firſt and ſuperior Part is called *Os Ilium*; the Inteſtine *Ilium* lieth between it, and its Fellow. It is very large, almoſt of a ſemi-circular Figure, a little convex, and uneven on its external Side which is called its *Dorſum*, and concave and ſmooth on its internal Side, which is called its *Coſta*. Its Circumference or Edge is called its *Spine*. It is joined to the Sides of the three ſuperior *Vertebræ* of the *Os Sacrum* by a true Suture: It is larger in Women than in Men.

The

Os Pubis.

The ſecond is the *Os Pubis*, which is the inferior and fore Part of the *Os Innominatum*; it is united to its Fellow of the other Side by an intervening Cartilage, by which means it makes the fore Part of the Pelvis or Baſon, of which the *Os Sacrum* is the back Part, and the *Ilia* the Sides.

Os Iſchium.

The third is the inferior and poſterior called *Iſchium*, or *Coxendix*; it has a large Cavity called *Acetabulum Coxendicis*, which receives the Head of the Thigh-Bone; the Circumference of this Cavity is tipt with a Cartilage called its *Supercilium*, where it joins the *Os Pubis*; it has a large Hole called *Foramen Iſchii & Pubis*, about the Circumference of which the Muſcles called *Obturator Internus* and *Externus* ariſe. And at its lower End it has a large Protuberance upon which we ſit, and from whence the Benders of the Leg ariſe. And a little above this, upon its hinder Part, it has another ſmall acute Proceſs, betwixt which and the former Protuberance lies the *Sinus* of the *Iſchium*, through which the Tendon of the *Obturator Internus* paſſes.

SECT. X.

Of the Ribs.

Coſtæ.

Sternum.

THERE are four and twenty Ribs, twelve on each Side of the twelve *Vertebræ* of the Back; they are crooked, and like to the Segments of Circles; they grow flat and broad as they approach the *Sternum*, but the nearer they are to the *Vertebræ* they are rounder and thicker, at which End they have a round Head, which being covered with a Cartilage, is received into the *Sinus* in the Bodies of the *Vertebræ;* and at the Neck of each Head (except the two laſt Ribs) there is a ſmall Tubercle, which is alſo received into the *Sinus* of the tranſverſe Proceſſes of the ſame *Vertebræ.* The Ribs thus articulated make an acute Angle with the lower *Vertebræ.*

The Ribs have each a ſmall Canal or *Sinus,* which runs along their under Sides, in which lies a Nerve, Vein, and Artery. Their Extremities, which are faſtned to the *Sternum,* are Cartilaginous, and the Cartilages make an obtuſe Angle with the bony Part of the Rib; this Angle reſpects the Head. The Cartilages are harder in Women than in Men, that they may the better bear the Weight of their Breaſts.

The Ribs are of two Sorts; the ſeven upper are called *Coſtæ Veræ,* becauſe their Cartilaginous Ends are received into the *Sinus* of the *Sternum.* The five lower are called *Falſæ,* becauſe they are ſhorter and ſofter, of which only the firſt is joined to the Extremity of the *Sternum;* the Cartilaginous Extremities of the reſt are tied to one another, thereby leaving greater Space for the Dilatation of the Stomach and Entrails. The laſt of theſe falſe Ribs is ſhorter than all the reſt; it is not tied to them, but ſometimes to the Midriff, and ſometimes to the *Muſculus obliquus Deſcendens.*

If the Ribs had been articulated with the

Bodies of the *Vertebræ* at right Angles, the Cavity of the *Thorax* could never have been enlarged in breathing. If each Rib had been a rigid Bone articulated at both Ends to two fixed Points, the whole Cheſt had been immoveable. If the Ribs had not been articulated to the tranſverſe Proceſſes of the *Vertebræ*, the *Sternum* could not have been thruſt out to that Degree it is now, or the Cavity of the *Thorax* could not have increaſed ſo much as is requiſite in Inſpiration. For, when the Ribs are pulled up by the Intercoſtal Muſcles, the Angle, which the Cartilages at the *Sternum* make with the bony Part of the Rib, muſt be encreaſed, and conſequently its Subtenſe, or the Diſtance between the *Sternum* and the tranſverſe Proceſſes, lengthened. Now, becauſe the Rib cannot move beyond the tranſverſe Proceſs, upon the Account of its Articulation with it; therefore the *Sternum* muſt either be thruſt to the other Side, or elſe outwards. It cannot move to the other Side, becauſe of an equal Preſſure upon the ſame Account there; and therefore it is thruſt outwards, or the Diſtance between the *Sternum* and the *Vertebræ* is encreaſed. The laſt Ribs, which do not reach the *Sternum*, and conſequently conduce nothing in this Action, are not articulated with the tranſverſe Proceſſes.

If we ſuppoſe the Cavity of the *Thorax* to be half a Sphæriod, whoſe Semi-Axis is the Height of the *Thorax*, or 15 Inches, and the Diameter of its greateſt Circle 12 Inches, then the Cavity of the *Thorax* contains 1130 Cubick Inches. But in an eaſy Inſpiration the *Sternum* is raiſed one Tenth of an Inch (as I am aſſured by an exact Experiment) upon which Account the Cavity of the *Thorax* is encreaſed to 1150 Cubick Inches. To this if we add the Space the *Diaphragma* leaves; which is the Segment of a Sphere, whoſe Diameter is 15 Inches, and the Solidity of the Segment 183 Inches, we ſhall have 22 Inches more, if the *Diaphragma* deſcends but one Inch; but if it deſcends an Inch and a half, it leaves Room for 52 Inches of Air to enter: and if it deſcends two Inches, the Cavity of the *Thorax* will be increaſed upon the Account of the Motion of the *Diaphragma* alone 86 Inches. So that in the leaſt Inſpiration we can fairly ſuppoſe the Lungs are diſtended with 42 Inches of Air, and they may be ſometimes with above 70 or 100.

SECT. XI.

Of the Breaſt-Bone.

Sternum. THE *Sternum* or Breaſt-Bone is ſituated in the Middle of the Breaſt; it is compoſed of ſeven or eight Bones in Infants, which at firſt are Cartilaginous, but which harden and unite into three Bones after they are ſeven Years old; The Subſtance of theſe Bones is not ſolid, but ſomewhat ſpongeous.

The firſt and uppermoſt Bone is the biggeſt and largeſt: it is uneven and rough on its Outſide, but ſmoother on its Inſide, where it has a ſhallow Furrow which gives way for the Deſcent of the Wind-Pipe. It has a *Sinus* lined with a Cartilage on each Side of its upper End, wherein it receives the Heads of the *Claviculæ*.

The ſecond is longer and narrower than the firſt, and on its Sides there are ſeveral *Sinus*'s, in which the Cartilaginous Ends of the Ribs are received.

The third is ſhorter, but broader than the ſecond; it receives into the Lateral *Sinus*'s the Extremities of the laſt true Ribs; it terminates into a Cartilage which hardens ſometimes into a Bone, called *Cartilago Xiphoides*, or *Enſiformis*, becauſe it is broad at its upper End, where it joins the third Bone, and grows narrower to its Extremity, where it is ſometimes forked, and ſometimes it bends inwards, compreſſes the upper Orifice of the Stomach, and cauſes a great Pain and Vomiting.

The Uſe of the *Sternum* is to defend the Heart, and to receive the Extremities of the true Ribs.

SECT. XII.

Of the Claviculæ *and* Scapulæ.

THE *Claviculæ* or Channel-Bones are two in Number, ſituated at the Baſis of the Neck, above the Breaſt, one on each Side; they are pretty long and ſmall; at one End they are joined to the Production of the *Scapula*, called *Acromion*, by the Articulation called *Synchondroſis*; at the other End, to the upper End of the *Sternum* by

Claviculæ.

the Articulation called *Arthrodia*; they are crooked like an *Italian (ſ)* for the Paſſage of the Veſſels which paſs under them, and to facilitate the Motion of the Arms.

Their Subſtance is ſpongeous, therefore they are the more eaſily broken, and the ſooner united when broken: Their Uſe is to ſuſtain the *Scapulæ* to which the Arms are articulated. And becauſe the Pectoral Muſcle, which pulls the Arm acroſs the Breaſt, is inſerted near the upper End of the *Humerus* Bone; therefore, if the *Clavicula* did not keep the *Scapula*, to which the Head of the *Humerus* is joined, always at an equal Diſtance from the *Sternum*, the upper Part of the Arm, and not the Hand, muſt have been pulled forwards.

The *Scapula*, Ὁμοπλάτα, or Shoulder-blades, are two large and broad Bones like the Triangle called *Scalenum*; they are ſituated on each Side of the upper and back Part of the *Thorax*. The Subſtance of the *Scapula* is thin, but ſolid and firm; its Outſide is ſomewhat convex, and its Inſide concave; its upper Edge is called *Coſta Superior*, and its lower *Coſta Inferior*; its broad End is called its *Baſis*, which, with the two Edges, make the upper and lower Angles. They have each three Proceſſes, of which the firſt runs all along the Middle of their Outſide, and it is called their *Spine*, that End of the *Spine* which receives the Extremity of the *Clavicula* is called *Acromion*. The ſecond Proceſs is a little lower than the *Acromion*; it is ſhort and ſharp like a Crow's Bill, therefore called *Caracoides*; theſe two Proceſſes are tied to one another by a ſtrong Ligament which ſerves to keep the Head of the *Humerus* in the Cavity of the third Proceſs, which is called *Cervix*. This Proceſs is the Extremity of the *Scapula*, which is opoſite to its Baſis. It has a round *Sinus* tipt about its Brim with a Cartilage, which receives the Head of the *Humerus*.

The Uſe of the *Scapula* is to receive the Extremities of the *Clavicula* and *Humerus*, for the eaſier Motion of the Arm, and to give a Riſe to the Muſcles which move the Arm.

SECT. XIII.

Of the Bones of the Arms and Hands.

THE firſt Bone of the Arm is the *Humerus*, or Shoulder-Bone; it is long and round. Its Subſtance, or Fibres, are pretty ſolid and compact; it has a pretty wide and long Cavity in its Middle, in which is contained its Morrow. At its upper End it has a round Head covered with a Cartilage, which is received into the Cavity of the Neck of the *Scapula*. In the fore Part of the Head there is a Channel in which a Tendon of the *Biceps* lies: But becauſe this Head is much larger than the Cavity, therefore there is a ſtrong Ligament which riſes from the Edge of the Cavity of the *Scapula*, and forming a Bag round the Head of the *Humerus*, is inſerted between the *Epiphyſis* and the Bone. Thus the Articulation of the *Hume-*

The **Humerus.**

rus with the *Scapula* is an *Arthrodia,* or Ball and Socket, that the Arm might have all manner of Motions; but the greateſt Part of the Socket is made of a Ligament: For though the Joint would have been ſtronger, if the Cavity had been all of Bone; yet the Neck of the *Humerus* being large and ſtrong, the Compaſs of the Arm muſt have been very ſmall. The lower End of the *Humerus,* which is thinner and broader than the other, has two Protuberances. The External is received into the Extremity of the *Radius;* from the Internal the Muſcles, which bend the Fingers and Hand, riſe; and between theſe two Protuberances there are two ſmall ſemi-circular Riſings, with a middle Channel, by which the *Humerus* is joined to the *Ulna* by a *Ginglymus.* On the Foreſide of theſe Protuberances there is a ſmall *Sinus* which receives the fore Proceſs of the *Ulna;* and on the Backſide there is another large *Sinus* which receives the *Olecranum.*

Ulna. The *Ulna,* or *Cubitus,* is a long and hard Bone with a Cavity in its Middle; it lies on the Inſide of the fore Arm, reaching from the Elbow to the Wriſt; it is big at its upper End, and grows ſmaller to its lower End. At its upper it has two Proceſſes which are received into the fore and hind *Sinus*'s of the Extremity of the *Humerus:* The foremoſt Proceſs is ſmall and ſhort; the hindmoſt, called Ολέκρανον, is bigger and longer; it ſtays the fore Arm when it comes to a ſtraight Line with the Arm. Betwixt theſe Proceſſes it has a ſemi-circular *Sinus,* which receives the inner Protuberance of the lower End of the *Humerus*, upon which we bend and extend our fore Arm. And along the Middle of that there runs a ſmall Ridge by which the Bone is articulated to the *Humerus* by a *Ginglymus*. Had the Articulation here been an *Arthrodia*, the Joint muſt have been much weaker, but the Hand could have received no more Motion from it than it has now from the Shoulder.

The Inſide of this upper End has a ſmall *Sinus* which receives the Circumference of the round Head of the *Radius*. Its lower Extremity, which is round and ſmall, is received into a *Sinus* in the lower End of the *Radius*; and upon this Extremity it has a ſhort and ſmall Proceſs, from which the Ligaments, which tie it to the Bones of the Wriſt, ariſe; this Proceſs ſerves to keep the Bones of the Wriſt in their Place.

Radius. The *Radius* is another Bone of the fore Arm, which accompanies the *Ulna* from the Elbow to the Wriſt; in its upper End it has a ſmall Cavity which receives the outer Protuberance of the *Humerus*. The Circumference of this Cavity rolls in the ſmall *Sinus* in the upper End of the *Ulna*. Near its lower End, which is bigger than its upper, it has a little *Sinus* which receives the End of the *Ulna*; and in its Extremity it has two *Sinus*'s which receive the Bones of the Wriſt. Although the *Ulna* and the *Radius* accompany one another, yet they touch not but at their Extremities. They bend from one another in their Middle, but they are tied together by a ſtrong and broad membranous Ligament.

The upper End of the *Ulna* is the biggeſt, becauſe upon it, and not upon the *Radius*, the Articulation at the Elbow is performed; but the lower End of the *Radius* is biggeſt, becauſe upon it only the Hand is articulated. The *Radius* moves either backwards or forwards upon the *Ulna*, by which means the Palm of the Hand is turned either upwards or downwards, which two Motions are called *Pronation* and *Supination*. Nor could any other Articulation have given theſe two Motions to the Hand; for though an *Arthrodia* admits of a Motion to every Side, yet we cannot by that turn the fore Part of our Arm backwards; and how uſeleſs our Hands had been without theſe Motions, every one may eaſily perceive.

Of the Bones of the Carpus.

The *Carpus*, or Wriſt, is made up of eight little Bones of a different Figure and Bigneſs; they are placed into two Ranks, four in each Rank. The firſt Rank is articulated with the *Radius*. The ſecond with the Bones of the *Metacarpus*. The laſt little Bone of the firſt Rank lies not at the Side of the third, which anſwers to the Bone of the *Metacarpus* of the little Finger, as all the reſt do by one another, but it lies upon it. They are ſtrongly tied together by the Ligaments which come from the *Radius*; and by the Annulary Ligament, through which the Tendons which move the Finger paſs. Although this Ligament be thought but one, yet it gives a particular Caſe to every Tendon which paſſes through it.

The Bones of the Metacarpus.

The *Metacarpus* is made up of four Bones which anſwer the four Fingers; that which ſuſtains the Fore-finger is the biggeſt and longeſt; they are round and long, a little convex and round towards the Back of the Hand, and concave and plain towards the Palm. They are hollow in the Middle, and full of Marrow; they touch one another only at their Extremities, leaving Spaces in their Middle, in which ly the *Muſculi Interoſſei*. In their End there is a *Sinus* which receives the Bones of the Wriſt, and their lower Extremity is round, and is received into the *Sinus* of the firſt Bones of the Fingers.

The Bones of the Fingers.

The Bones of the Fingers and Thumb are fifteen in each Hand, three to each Finger; they are a little convex and round towards the Back of the Hand, but hollow and plain towards the Palm, except the laſt where the Nails are. The Order of their Diſpoſition is called firſt, ſecond, and third *Phalanx*. The firſt is longer than the ſecond, and the ſecond than the third. The upper Extremity of the firſt Bone of each Finger has a little *Sinus* which receives the round Head of the Bones of the *Metacarpus*. The upper Extremity of the ſecond and third Bones of each Finger hath two ſmall *Sinus*'s, parted by a little Protuberance; and the lower Extremity of the firſt and ſecond Bones of each Finger has two Protuberances, divided by a ſmall *Sinus*. The two Protuberances are received into the two *Sinus*'s of the upper Extremity of the ſecond and third Bones; and the ſmall *Sinus* receives the little Protuberance of the ſame End of theſe ſame Bones. The firſt Bone of the Thumb is like to the Bones of the *Metacarpus*, and it is joined to the Wriſt and ſecond of the Thumb, as they are to the Wriſt and firſt of the Fingers. The ſecond Bone of the Thumb is like the firſt Bones of the Fingers, and it is joined to the firſt and third, as they are to the Bones of the *Metacarpus*, and ſecond of the Fingers. The Fingers are moved ſideways only upon the firſt Joint.

Oſſa Seſamoidæa. Beſides theſe Bones, there are ſome ſmall ones, called *Oſſa Seſamoidæa,* becauſe they reſemble the Grains of *Seſamum;* they are reckoned about twelve in each Hand; they are placed at the Joints of the Fingers, under the Tendons of the *Flexores Digitorum,* to which they ſerve as ſo many Pulleys.

SECT. XIV.

Of the Bones of the Thighs, Legs and Feet.

THE Thigh has only one Bone, which is the longeſt of all the Bones of the Body: Its Fibres are cloſe and hard; it has a Cavity in its Middle; it is a little convex and round on its Foreſide, but a little hollow, with a long and ſmall Ridge called *Linea Aſpera* on its Backſide. At its upper End it has three *Epiphyſes,* which ſeparate eaſily in Children.

The firſt is its Extremity, which is a large and round Head covered with a Cartilage, which is received into the *Acetabulum Coxendicis;* wherein it is tied by two Ligaments. The firſt is pretty large, and comes from the

Edge of the *Acetabulum*. The ſecond is round and ſhort, it comes from the Bottom of the *Acetabulum*, and is inſerted into the Middle of the round Head: The Part immediately below this round Head, which is ſmall, long, and a little oblique, is called its Neck. It makes an Angle with the Body of the Bone, by which means the Thighs and Feet are kept at a Diſtance from one another, and we ſtand firmer, the *Lineæ Propenſionis* eaſily falling perpendicular upon any Part of the quadrangular Space between the Feet. Beſides this Obliquity of the Neck of the Bone, it conduces much to the Strength of the Muſcles of the Thigh, which muſt have otherwiſe paſſed very near to the Center of Motion.

Trochanter Major.

The ſecond is called *Trochanter Major*; it is a pretty big Protuberance on the external Side of the Thigh-Bone, juſt at the Root of the Neck; it is rough, becauſe of the Inſertion of ſome Muſcles into it. It has a ſmall Dent at its Root, into which the *Muſculi Quadragemini*, and the *Obturatores*, are inſerted.

Trochanter Minor.

The third is called *Trochanter Minor*; it is on the Hind-ſide of the Thigh-bone, a little lower and leſs than the other. Theſe Protuberances encreaſe mightily the Force of the Muſcles, by removing not only their Inſertions, but likewiſe the Directions, from the Center of Motion.

The lower Extremity of the Thigh-bone, which is articulated with the *Tibia* by *Ginglymus*, is divided into the Middle by a *Sinus* into two Heads, or Protuberances, the external and the internal, which are received into the upper *Sinus*'s of the *Tibia*. Through the Space that is between the hind Parts of theſe two Heads paſs the great Veſſels and Nerve which go to the Leg; becauſe the upper End of the Thigh-bone was articulated by an *Arthrodia*, that we might not only move our Legs backwards or forwards, but likewiſe nearer to, or farther from one another; therefore its lower Extremity was joined to the *Tibia* by *Ginglymus*, which is the ſtrongeſt Articulation.

Patella. In the Knee there is a little round Bone about two Inches broad, pretty thick, a little convex on both Sides, covered with a ſmooth Cartilage on its Fore-ſide; it is ſoft in Children, but very hard in thoſe of riper Years; it is called *Molla*, *Patella*, or Pan; over it paſs the Tendons of the Muſcles which extend the Leg, to which it ſerves as a Pulley for facilitating their Motion, by removing their Direction from the Center of Motion.

Tibia. In the Leg there are two Bones, the inner and bigger is called *Tibia* or *Focile Majus*; it is hard and firm, with a Cavity in its Middle; it is almoſt triangular; its fore and ſharp Edge is called the Shin. In its upper Extremity it has two large *Sinus*'s tipt with a ſoft and ſupple Cartilage called *Cartilago Lunata* from its Figure: It runs in between the Extremities of the two Bones, and becomes very thin at its Edge. Like thoſe in the Articulation of the Lower Jaw, it facilitates a ſmall Side-motion in the Knee. The *Sinus*'s receive the two Protuberances of the Thigh-bone, and the Production which is between the *Sinus*'s of the *Tibia* is received in the *Sinus* which divides theſe two Protuberances of the *Femur*. By bending our Knee, we bring our Leg in walking in a ſtraight Line forwards, which, without this Articulation, we could not have done, but, like thoſe who have the Misfortune to have a wooden Leg, we muſt have brought our Foot about in a Semi-circle in going even upon a Plain, but more evidently upon an Aſcent.

On the Side of this upper End it has a ſmall Knob, which is received into a ſmall *Sinus* of the *Fibula*; and on its fore Part, a little below the *Patella*, it has another, into which the Tendons of the Extenſors of the Leg are inſerted. Its lower Extremity, which is much ſmaller than its upper, has a remarkable Proceſs which forms the inner Ancle, and a pretty large *Sinus* divided in the Middle by a ſmall Protuberance; the *Sinus* receives the convex Head of the *Aſtragalus*, and the Protuberance is received into the *Sinus* in the convex Head of the ſame Bone. It has another ſhallow *Sinus* in the Side of its lower End, which receives the *Fibula*.

Fibula.

The outer and leſſer Bone is called Περόνη *Fibula*, or *Focile Minus*: Though it be much ſmaller than the *Tibia*, yet it is nothing ſhorter. It lies in the Outſide of the Leg, and its upper End, which is not ſo high as the Knee, receives the lateral Knob of the upper End of the *Tibia* into a ſmall *Sinus* which it has in its inner Side. Its lower End is received into the ſmall *Sinus* of the *Tibia*, and then it extends into a large Proceſs which forms the outer Ancle, embracing the external Side of the *Aſtragalus.* The *Tibia* and *Fibula* touch not one another but at their Ends; the Space which they leave in their Middle is filled up by a ſtrong membranous Ligament, and ſome Muſcles which extend the Feet and Toes.

In the Foot we diſtinguiſh three Parts, the *Tarſus*, *Metatarſus*, and Toes.

The Bones of the Tarſus *are the* Talus. Aſtragalus.

The *Tarſus* is the Space between the Bones of the Leg and the *Metatarſus;* it is compoſed of ſeven Bones.

The firſt is called the *Aſtragalus* or *Talus;* in its upper Part it has a convex Head, which is articulated with the two *Fociles* of the Leg by *Ginglymus*, being it is divided by a little *Sinus* which receives the ſmall Protuberance in the Middle of the *Sinus* of the *Tibia.* And without this Articulation we muſt always, in going, have trode upon the Heel with our fore Foot, and upon our Toes with our hind Foot. The fore Part of the *Aſtragalus*, which is alſo convex, is received into the *Sinus* of the *Os Naviculare.* Below, towards the hind Part of its under Side, it has a pretty large *Sinus*, which receives the upper and hind Part of the *Os Calcis.* But towards the fore Part of the ſame Side it has a Protuberance, which is received into the upper and fore Part of the ſame Bone. Betwixt this *Sinus* and this Protuberance there is a Cavity which anſwers to another in the *Os Calcis*, in which is contained an oily and mucous Sort of Subſtance for moiſtning the Ligaments, and facilitating the obſcure Motion of theſe Bones when we go.

Calcaneum.

The ſecond Bone of the *Tarſus* is the *Calcaneum, Os Calcis*, or Heel-bone; it is the biggeſt of the Bones of the *Tarſus*. It lies under the *Aſtragalus*, to which it is articulated by *Ginglymus*, as we have now deſcribed. Behind it has a large Protuberance which makes the Heel, and into which the *Tendo Achillis* is inſerted; and before it has a Cavity which receives a Part of the *Os Cubiforme*.

Naviculare.

The third is the *Os Naviculare* or *Cymbiforme*; it lies between the *Aſtragalus* and the three *Oſſa Cuneiformia*. Behind it has a large *Sinus*, which receives the fore Convex Head of the firſt; and before it is Convex, diſtinguiſhed into three Heads, which are received into the *Sinus*'s of the *Oſſa Cuneiformia*.

Oſſa Cuneiformia.

The fourth, fifth and ſixth are called *Oſſa Cuneiformia*, becauſe they are large above, and narrow below; they ly all three at the Side of one another; their upper Side is Convex, and their under hollow, by which Means the Muſcles and Tendons in the Sole of the Foot are not hurt when we go. At one End they have each a *Sinus*, which receives the *Os Naviculare*, and at the other End they are joined to the three inner Bones of the *Metatarſus*; the inmoſt of theſe Bones is the biggeſt, and that in the Middle the leaſt.

Os Cubiforme.

The ſeventh Bone is called the *Os Cubiforme*, becauſe of its Figure; it lies in the ſame Rank with the *Oſſa Cuneiformia*. Behind it is joined to the *Os Calcis*, before to the two outer Bones of the *Metatarſus*, and on its Inſide is joined to the third *Os Cuneiforme*.

Metatarſus. The Bones of the *Metatarſus* are five; that which ſuſtains the great Toe is the thickeſt, and that which ſuſtains the next Toe is the longeſt, the reſt grow each ſhorter than another. They are longer than the Bones of the *Metacarpus*; in other Things they are like them, and they are articulated to the Toes, as they are to the Fingers.

The Bones of the Toes. The Bones of the Toes are Fourteen. The great Toe hath two, and the reſt have each three; they are like to the Bones of the Fingers, only they are ſhorter.

In the Toes there are ſometimes found Twelve *Oſſa Seſamoidæa*, as in the Fingers.

SECT. XV.

Of the Nails, and Number of the Bones.

THE Nails which are upon the Extremities of the Fingers and Toes ſeem to be of the ſame Nature as the Hoofs of other Animals. If you take the Hoof carefully off a Horſe, Ox, or Hog, you ſhall ſee that it is nothing but a Bundle of ſmall Huſks which anſwer to ſo many *Papillæ* of the Skin. From whence we may conclude, that the Nails are nothing but the Covers or Sheaths of the *Papillæ Pyramidales* of the Skin on the Extremities of the Fingers and Toes, which dry, harden, and ly cloſe upon one another: Their Uſe is to defend the Ends of the Fingers when we handle any hard or rugged Body.

The Bones of a Skeleton are,

The *Os Frontis*	1
Occipitis	1
Oſſa Parietalia	2
Temporum	2
Oſſicula Auditus	8
Os Ethmoides	1
Sphænoides	1
Mali	2
Maxillare	2
Unguis	2
Naſi	2
Palati	2
Vomer	1
Maxilla Inferior	1
Dentes Inciſivi	8
Canini	4
Molares	20
Os Hyoides	1
	61
Vertebræ Cervicis	7
Dorſi	12
Lumborum	5
Oſſis Sacri	6
Os Coccigis	3
Scapulæ	2
Claviculæ	2
Coſtæ	24

Sternum	1
Oſſa Innominata	2
	64
The *Humerus*	2
Ulna	2
Radius	2
Oſſa Carpi	16
Metacarpi	8
Digitorum	30
	60
The *Os Femoris*	2
Rotulæ	2
Tibia	2
Fibula	2
Oſſa Tarſi	14
Metatarſi	10
Digitorum	28
	60
In all	245

Beſides the *Oſſa Seſamoidæa,* which are ſaid to be found to the Number of 48.

CHAP.

CHAP. VI.

Of the Muſcles which are not yet deſcribed.

SECT. I.

Of the Muſcles of the Face.

THE Eye-brows have each a Muſcle called *Corrugator*. It ariſes from the great *Canthus* of the Orbit, and terminates in the Skin about the Middle of the Eye-brows. Some reckon this Pair only a Prolongation of the *Frontale's*; their Name declares their Uſe.

The Noſe has three Muſcles. The firſt ariſes from the End of the upper two Bones of the Noſe, and are inſerted into the upper Part of the *Alæ*. They pull the Noſe upwards.

The ſecond Pair ariſe from the *Os Maxillare*, and are inſerted into the Sides of the *Alæ*. They dilate the Noſtrils.

The third Pair ariſes from the ſame Bone, above the *Dentes Inciſorii*, and are inſerted into the Extremities of the *Alæ*, which they pull downwards.

The Muſcles of the Lips are five proper Pair.

The *Inciſivus*, or *Elevator Labii Superioris*; it ariſes from the upper Part of the ſecond Bone of the upper Jaw, and deſcending

ing obliquely, is inſerted into the upper Lip above the *Dentes Inciſorii.*

Its Antagoniſt is the *Triangularis,* or *Depreſſor Labii Superioris;* it ariſeth from the lower Edge of the lower Jaw, between the *Maſſeter* and the *Quadratus,* and aſcendeth by the Angle of the Mouth to the upper Jaw.

The *Caninus,* or *Elevator Labii Inferioris;* it ariſeth from the ſecond Bone of the upper Jaw, below the *Inciſivus;* it deſcends and paſſes under the Inſertion of the *Zygomaticus,* and is inſerted into the under Lip. This Muſcle is aſſiſted by another ſmall but ſtrong Pair of Muſcles, firſt obſerved by Mr. *Cowper,* and by him called *Elevator Labii Inferioris:* They ariſe from the Gums of the *Dentes Inciſorii,* and deſcending directly, are inſerted into the lower Part of the Skin of the Chin. When they act, they pull the Skin of the Chin, and conſequently thruſt the lower Lip upwards.

Its Antagoniſt is the *Quadratus,* or *Depreſſor Labii Inferioris;* this is ſome thin fleſhy Fibres, which ly immediately under the Skin upon the Chin, on each Side of the former; they ariſe from the Edge of the fore Part of the under Jaw, and are inſerted into the upper Lip.

There are three Muſcles common to both the Lips.

The firſt and the ſecond are *Zygomatici,* one on each Side; they come from the *Os Zygoma,* and going obliquely, they are inſerted near the Angles of the Lips. When one of theſe Muſcles acteth, it draws both Lips obliquely to a Side; they receive often ſome Fibres from the *Caninus*.

The third is the *Orbicularis,* or *Sphincter Labiorum;* it ſurrounds the Lips with Orbicular Fibres; when it acteth, it draws the Lips.

There is one Muſcle on each Side, common to the Lips and Cheeks, which is the *Buccinator;* it lies under the other Muſcles; it makes the inner Subſtance of the Cheeks; its Fibres run from the *Proceſſus Coronæ* of the lower Jaw to the Angle of the Mouth, and they adhere to the upper Part of the Gums of both Jaws. Through its Middle paſs the upper *Ductus Salivales;* by this Muſcle we contract the Cavity of our Mouth, and thruſt the Meat between our Teeth.

The Muſcles of the lower Jaw are twelve Pair, ſix on each Side.

The firſt is the *Temporalis,* or *Crotaphites;* it ariſes by a ſemi-circular fleſhy Beginning from a Part of the *Os Frontis,* from the lower Part of the *Parietalia* and upper Part of the *Temporale.* From thence they go under the *Zygoma,* and gathering together as to their Center, they are inſerted by a ſhort but ſtrong Tendon into the *Proceſſus Coronæ* of the lower Jaw.

The ſecond is the *Maſſeter;* it is a thick and ſhort Muſcle; it ariſes from the *Zygoma,* and from the firſt Bone of the upper Jaw, and is inſerted into the lower Edge of the lower Jaw, from its external Angle to its Middle. Its Fibres run in three Directions; thoſe which come from the *Zygoma* run obliquely to the Middle of the Jaw; and thoſe from the firſt Bone of the upper Jaw croſs the former, and run to the Angle of the lower Jaw; and the Fibres which are in its Middle run in a perpendicular from their Origin to their Inſertion. Theſe two Muſcles pull the Jaw upwards.

The third is the *Pterigoidæus Internus*; it ariſes from the internal Part of the *Proceſſus Pterigoidæus*; and deſcends to be inſerted into the inferior Part of the internal Side of the lower Jaw, near its Angle: When this Muſcle acteth, it draweth the Jaw to a Side.

The fourth is the *Pterigoidæus Externus*; it ariſes from the external Part of the ſame Proceſs, and goes backwards to be inſerted between the *Proceſſus Condiloides* and the *Corona* on the Inſide of the lower Jaw. This Muſcle pulleth the lower Jaw forwards.

The fifth is the *Quadratus*; this is a broad membranous Muſcle, which lies immediately under the Skin; it ariſeth from the upper Part of the *Sternum*, from the *Claviculæ*, and from the *Acromium*; it covereth all the Neck, and adheres firmly to the lower Edge of the lower Jaw; and, being produced, it covers alſo the lower Part of the Cheeks. When this Muſcle acteth, it pulleth the Cheeks and Jaw downwards.

The ſixth is the *Digaſtricus*; it ariſeth fleſhy from the upper Part of the *Proceſſus Maſtoidæus*, and deſcending, it contracts into a round Tendon, which paſſes through the *Stylohyoidæus*, and an annular Ligament which is fixed to the *Os Hyoides*; then it grows fleſhy again, and aſcends to the Middle of the Edge of the lower Jaw, where it is inſerted. When this Muſcle acteth, it pulleth the lower Jaw down, by help of the annular Pulley, which alters its Direction.

SECT. II.

Of the Muſcles of the Head.

THE Head is lifted up or pulled backwards by four Pair of Muſcles.

The firſt is the *Splenius*, which ariſeth from the four upper Spines of the *Vertebræ* of the Back, and from the two lower of the Neck; and aſcending obliquely, it adheres to the upper tranſverſe Proceſſes of the *Vertebræ* of the Neck, and is inſerted into the upper Part of the *Occiput*.

The ſecond is the *Complexus*; it ariſeth from the tranſverſe Proceſſes of the *Vertebræ* of the Neck, and aſcending obliquely, it adheres to the Spines of the ſame *Vertebræ*, and is inſerted into the *Occiput*: When one of theſe Muſcles acteth, it moves the Head backwards to one Side.

The third is the *Rectus Major*; it ariſeth from the Spine of the ſecond *Vertebra* of the Neck, and is inſerted into the lower Part of the *Occiput*.

The fourth is the *Rectus Minor*; it lies under the *Major*: It cometh from the back Part of the firſt *Vertebra* of the Neck, and is inſerted below the former: They nod the Head backwards.

The ſemi-circular Motion of the Head is performed by

The *Obliquus Inferior*, which comes from the Spine of the ſecond *Vertebra* of the Neck, and is inſerted into the tranſverſe Proceſs of the firſt.

The *Obliquus Superior* comes from the tranſverſe Proceſs of the firſt *Vertebra* of the Neck, and is inſerted into the lateral and inferior Part of the *Occiput*.

The *Maſtoidæus* ariſes fleſhy from the upper Part of the *Sternum* and Extremity of the *Claviculæ*; and aſcending obliquely, it is inſerted into the back Part of the *Proceſſus Mamillaris*. When either of theſe Muſcles act, the Head turneth to the contrary Side.

The Head is bended forwards by

The *Rectus Internus Major*, which ariſes from the fore Part of the five interior tranſverſe Proceſſes of the *Vertebræ* of the Neck, and is inſerted into the foremoſt *Appendix* of the Occipital Bone, near its great Hole.

The *Rectus Internus Minor*, obſerved and deſcribed by that accurate Anatomiſt Mr. *Cowper*, in his moſt exact Treatiſe of the Muſcles; it lies on the fore Part of the firſt *Vertebra*, like the *Rectus Minor* on the back Part, and is inſerted into the *Anterior Appendix* of the *Os Occipitis* immediately under the former. Theſe nod the Head forwards, being Antagoniſts to the *Recti Minores*.

Fallopius has deſcribed another Pair, called *Recti Laterales*, which come from the tranſverſe Proceſſes of the firſt *Vertebra*, and are inſerted near the *Proceſſus Mamillaris*; they help to move the Head a little to one Side.

SECT.

SECT. III.

Of the Muſcles of the Neck.

THE Neck is bended and extended; it is bended by two Pair of Muſcles.

The firſt is the *Longus*, which is faſtened to the Bodies of the five upper *Vertebræ* of the Back, and to all thoſe of the Neck; but becauſe the laſt are more moveable than the firſt, therefore they are its Inſertion, and thoſe of the Back its Origination.

The *Scalenus* ariſes from the firſt and ſecond Ribs; and aſcending, is inſerted into all the tranſverſe Proceſſes of the Neck, except the firſt. This Muſcle ſeems to be three; yet I will not increaſe their Number. It is perforated for the Paſſage of the Veins, Arteries, and Nerves; becauſe the Neck is more eaſily moved than that Part of the Ribs to which they are faſtened; therefore it is juſtly reckon'd among the Benders of the Neck.

The Neck is extended by the *Muſculi Vertebrales*, of which afterwards.

SECT. IV.

Of the Muſcles of the Scapula.

THE *Scapula* is moved backwards and forwards, upwards and downwards, by four Muſcles.

The firſt is the *Serratus Minor Anticus*; it ariſeth thin and fleſhy, from the ſecond, third, fourth, and fifth ſuperior Ribs, and aſcending obliquely, it is inſerted fleſhy into the *Proceſſus Coracoides* of the *Scapula,* which it draws forwards; it helps alſo in Reſpiration.

The ſecond is the *Trapezius,* or *Cucullaris,* becauſe with its Fellow it repreſents a Cowl; it ariſes from the *Occiput* above the *Splenius,* from the Spines of the *Vertebræ* of the Neck and from the eighth Superior of the Back, and is inſerted into the Spine of the *Scapula* to the *Acromium* and *Clavicle*; it moves the *Scapula* obliquely upwards, directly backwards, and obliquely downwards, according to the three Directions of its Fibres.

The third is the *Rhomboides,* ſo called from its Figure; it lies under the *Cucullaris*; it ariſeth from the two inferior Spines of the Neck, and four ſuperior of the Back; and is inſerted fleſhy into the whole Baſis of the *Scapula,* which it draws backwards.

The fourth is the *Levator Scapulæ*; it ariſes from the ſecond, fourth and fifth tranſverſe Proceſſes of the Neck by ſo many diſtinct Beginnings, which unite, and are inſerted into the ſuperior Angle of the *Scapula,* which it draws upwards: It is alſo called *Muſculus Patientiæ,* becauſe thoſe who are any ways grieved uſe it.

Theſe Muſcles may move the Arm, as thoſe of the Arm move it, becauſe of the Connection of the two Bones: They help alſo in Reſpiration.

S E C T.

SECT. V.

Of the Muſcles of Reſpiration; and of the Benders and Extenſors of the Vertebræ.

THE Cavity of the *Thorax* is dilated and contracted in Reſpiration, by nine and twenty Pair of Muſcles; five and twenty Pair pull the Ribs up, three Pair accelerate their Motion downwards, and one Pair, *viz.* the *Diaphragma*, helps both in the one and the other; this laſt we have deſcribed already.

The Muſcles which dilate the *Thorax* in Inſpiration are,

The *Intercoſtales Externi & Interni*; they are in Number four and forty, one of each Sort between every two Ribs; they ariſe from the lower Edge of each ſuperior Rib, and are inſerted into the upper Edges of each inferior Rib. Their Fibres decuſſate one another; thoſe of the external run obliquely from the back Part forwards, but thoſe of the internal from the fore Part backwards.

The *Subclavius* ariſes from the lower Side of the Half of the *Clavicula* that is neareſt the *Acromium*, and deſcends obliquely to be inſerted into the upper Part of the firſt Rib, near the *Sternum*.

The *Serratus Anticus Major*; it comes from the whole Baſis of the *Scapula*, and is inſerted into the ſeven true Ribs, and firſt of the falſe Ribs, by ſo many diſtinct Portions, which repreſent the Teeth of a Saw. The

Obliquus Deſcendens of the *Abdomen* lies between the Spaces of its lower Indentation.

The *Serratus Poſticus Superior;* it ariſeth by a broad and thin Tendon from the two Inferior Spines of the *Vertebræ* of the Neck, and the three ſuperior of the Back; and growing fleſhy, it is inſerted into the ſecond, third and fourth Ribs by ſo many diſtinct Indentations.

When all theſe Muſcles act, they draw the Ribs upwards, bringing the Ribs to right Angles with the *Vertebræ;* and conſequently the Cavity of the *Thorax* muſt be wider and ſhorter: But becauſe at the ſame Time the *Diaphragma* contracts, therefore the Cavity is alſo longer.

The Muſcles which contract the Cavity of the *Thorax* are,

The *Triangularis;* it ariſes from the lower Part of the Inſide of the *Sternum,* and is inſerted into the Cartilages where they join the Bones of the fourth, fifth, ſixth, and ſometimes ſeventh true Ribs.

The *Serratus Poſticus Inferior* ariſes by a broad and thin Tendon from the three inferior Spines of the *Vertebræ* of the Back, and from the two ſuperior of the Loins; its Fibres aſcending obliquely, grow fleſhy, and are inſerted by four Indentations into the four laſt Ribs.

The *Sacrolumbus;* it ariſes fleſhy from the ſuperior Part of the *Os Sacrum,* poſterior Part of the Spine of the *Ilium,* and from all the Spines and tranſverſe Proceſſes of the *Vertebræ* of the Loins: It gives a ſmall Tendon to the poſterior Part of each Rib near its Root, where a ſmall Bundle of fleſhy Fibres ariſes, and unites with each aſcending Tendon to the third, fourth, fifth and ſixth *Vertebræ* of the Neck. Theſe Muſcles are of ſmall Force, and ſeem only to accelerate the Motion of the Ribs, which fall down by their own Gravity, and the Elaſticity of the Ligaments, by which they are bound to the *Vertebræ*.

The Muſcles of the Back and Neck are very numerous, and variouſly deſcribed by Authors. I ſhall not multiply them, but take all that have the ſame Direction and Diſpoſition for the ſame Muſcle, though perhaps it may be divided into as many Muſcles as there are *Vertebræ*. The firſt is

The *Longiſſimus Dorſi*. This Muſcle at its Beginning is not to be ſeparated from the *Sacrolumbus*, ariſing with it from the back Part of the Spine of the *Ilium*, and upper Part of the *Os Sacrum*; and as it aſcends, it gives Tendons to each tranſverſe Proceſs of the *Vertebræ* of the Loins, *Thorax*, and Neck. When theſe Muſcles act, they keep the Body erect. Under this lies

The *Tranſverſalis Dorſi*, of which Authors commonly make three, *viz.* the *Sacer*, the *Semiſpinatus*, and *Tranſverſalis Colli*. This Muſcle ariſes from the *Os Sacrum*, and from all the tranſverſe Proceſſes of the *Vertebræ* of the Loins, Back, and Neck, except the two firſt; and is inſerted by ſo many diſtinct Tendons to all their ſuperior Spines: This Muſcle moves the whole Spine obliquely backwards.

The *Inter-Spinalis*, of which the firſt Part is called (by *Bidlow*) *Semi-Spinalis*, and the other Part (by Mr. *Cowper*, who firſt obſerved them) *Inter-Spinalis Colli*: They ariſe partly fleſhy and partly tendinous from the Spines of the Loins and the inferior of the *Thorax*, and are inſerted into the fifth, ſixth, and ſeventh Spines of the *Thorax*. Theſe join the *Longiſſimus Dorſi*. The other Part ariſes from the ſuperior Parts of each double Spinal Proceſs of the Neck, except that of the ſecond *Vertebra*, and is inſerted into the inferior Parts of all the ſaid Spines. Theſe Muſcles draw the Spines of the *Vertebræ* nearer one another.

The *Spinalis Colli*. It ariſes from the five ſuperior tranſverſe Proceſſes of the *Vertebræ* of the *Thorax*, and inferior of the Neck, and is inſerted with its Fellow into the inferior Part of the ſecond *Vertebra* of the Neck. They pull the Neck directly backwards.

The *Quadratus Lumborum*. It ariſeth from the poſterior Part of the Spine of the *Ilium*, and is inſerted into the Inſide of all the tranſverſe Proceſſes of the *Vertebræ* of the Loins. This Muſcle moves the Body upon the Loins to one Side, and both together help the *Rectus Abdominis* in bending our Body forwards.

The *Vertebræ* of the Neck are bended by two Pair of Muſcles, which have been already deſcribed. The *Vertebræ* of the Back have no Benders, and thoſe of the Loins are bended by the Muſcles of the Lower Belly, and by one proper Pair, which is called the *Pſoas Parvus*; it ariſes fleſhy from the Inſides of the upper *Vertebræ* of the Loins, and it has a thin and broad Tendon which embraces the *Pſoas* of the Thigh, and which is inſerted into the *Os Innominatum*, where the *Os Pubis* and *Ilium* join together.

SECT. VI.

Of the Muſcles of the Humerus, *or Arm.*

THE Arm moves five different Ways, upwards, downwards, forwards, backwards, and round.

The Arm is lifted upwards by the *Deltoides*, *Supra Spinatus*, *Coracobrachialis.*

The *Deltoides* is of a triangular Figure; it comes from all the *Spina Scapulæ*, from the *Acromium*, from the external Half of the *Clavicula*; from all theſe Places its Fibres drawing together, paſs above the Articulation of the *Humerus*, and are inſerted by a ſhort Tendon, four Fingers below the Head of the ſame Bone, almoſt on its external Side. *Steno* ſhews that this Muſcle is compoſed of twelve ſimple Muſcles: According to the Direction of its Fibres, it pulls alſo the Arm a little forwards and backwards.

The *Supra Spinatus* riſes fleſhy from all the Baſis of the *Scapula*, that is above the Spine. It fills all that Space between the upper Side of the *Scapula* and its Spine, to which too it is alſo attached: It paſſes above the *Acromium*, over the Articulation of the *Humerus*, and is inſerted into the Neck of the *Humerus*, which it embraces by its Tendon.

The *Coracobrachialis* riſes from the *Proceſ-*

ſus Caroides Scapulæ by a tendinous Beginning; and paſſing over the Articulation, it is inſerted into the Middle and internal Part of the *Humerus*.

The *Teres Major* and the *Latiſſimus Dorſi* pull the Arm downwards.

The *Teres Major* riſes from the lower Angle of the *Scapula*, and is inſerted with the following a little below the Head of the *Humerus*.

The *Latiſſimus Dorſi*, or *Aniſcaptor*, with its Fellow, covers almoſt all the Back. It hath a thin and large tendinous Beginning, which comes from the poſterior Part of the Spine of the *Ilium*, from the ſuperior Spines of the *Os Sacrum*, from all the Spines of the *Vertebræ* of the Loins, and from the ſeven lower of the *Thorax*; it paſſes by the inferior Angle of the *Scapula*, from which ſome of its fleſhy Fibres ſometimes ariſe, and is inſerted with the *Teres Major* by a ſtrong and broad Tendon.

The *Pectoralis* moves the Arm forwards; it ariſeth by a fleſhy and ſemi-circular Beginning from the inner Half of the *Clavicula* from the ſix ſuperior Ribs; it covereth a great Part of the Breaſt, and is inſerted by a ſhort but ſtrong and broad Tendon into the upper and inner Part of the *Humerus*, between the *Biceps* and *Deltoides*. Its Fibres near their Inſertion decuſſate each other. Thoſe which come from the *Clavicle* and firſt Ribs are on the lower Side of the Tendon; and thoſe from the inferior Ribs are on the upper Side of the Tendon.

The Arm is drawn backwards by the *Infra Spinatus*,

Spinatus, the *Tranſverſalis*, and the *Sub-ſcapularis*.

The *Infra Spinatus* covers all the Space that is between the Spine of the *Scapula* on its inferior Side; and paſſing between the Spine and the *Teres Minor*, it is inſerted into the Neck of the *Humerus*.

The *Tranſverſalis*, or *Teres Minor*, comes from the inferior Edge of the *Scapula*, upon which it runs between the former and the *Teres Major*, and is inſerted into the Neck of the *Humerus*.

The *Sub-ſcapularis* covers all the internal Side of the *Scapula*; it riſes fleſhy from its Baſis, from its upper and lower *Coſta*, and is inſerted into the Neck of the *Humerus*. It draweth the Arm cloſe to the Ribs.

The Tendons of theſe three laſt Muſcles ſurround the Articulation of the *Humerus*. When all theſe Muſcles move ſucceſſively, they move the Arm circularly.

SECT. VII.

Of the Muſcles of the Cubitus *and* Radius.

THE *Cubitus* is bended and extended by ſix Muſcles; the *Biceps* and *Brachiæus Internus* bend it; the *Longus*, *Brevis*, *Brachiæus Externus* and the *Anconæus*, extend it.

The *Biceps* is ſo called, becauſe it hath two Heads, of which one riſes from the upper Edge of the Cavity of the Head of the *Scapula*. This Head is round and tendinous, and is encloſed in the Channel in the Head of the *Humerus*.

Humerus. The other ariſes from the *Proceſſus Coracoides*, it is broad and tendinous; and both together unite about the Middle and fore Part of the Arm, and make one Belly, which is inſerted, by a ſtrong and round Tendon, into the Tubercle at the upper End of the *Radius*. Some of the Fibres of this Tendon from a large and thin *Aponeuroſis*, which covers all the Muſcles of the *Radius* and Fingers externally. Care ought to be taken in Blood-letting, not to cut acroſs, but according to the Length of the Fibres of the *Aponeuroſis*.

The *Brachiæus Internus* lies partly under the *Biceps*; it riſes by a fleſhy Beginning from the Middle and internal Part of the *Humerus*, and is inſerted into the upper and fore Part of the *Cubitus* by a very ſhort but ſtrong Tendon.

The *Longus* is the firſt of thoſe which extend the *Cubitus*; it ariſeth from the inferior *Coſta* of the *Scapula*, nigh its Neck, and paſſeth betwixt the two round Muſcles; it deſcendeth upon the back Side of the *Humerus*, where it joins with the two following:

The *Brevis* ariſes from the ſuperior and poſterior Part of the *Humerus*.

The *Brachiæus Externus* ariſes about the Middle and poſterior Part of the *Humerus*. Theſe three join their fleſhy Fibres together, and, being externally tendinous, they cover all the Elbow, and are inſerted into the *Olecranium*.

The *Anconius* is a ſmall Muſcle which ariſes from the back Part of the Extremity of the *Humerus*, paſſes over the Elbow, and is inſerted into the lateral and internal Part of the *Ulna*, about three or four Fingers Breadth below the *Olecranium*.

The *Radius* hath four Muſcles, two *Pronatores*, which turn the Palm of the Hand downwards, they are the *Rotundus* and the *Quadratus*; and two *Supinatores*, which turn the Palm upwards, they are called *Longus* and *Brevis*.

The *Rotundus* ariſes fleſhy from the internal Extuberance of the *Humerus*, and goes obliquely to be inſerted in the middle and external Part of the *Radius*.

The *Quadratus* ariſes by a broad and fleſhy Beginning from the lower and internal Part of the *Ulna*; it paſſes over the Ligament that joins the *Radius* to the *Ulna*, and is inſerted as broad at its Beginning into the external and lower Part of the *Radius*.

The firſt of the *Supinatores* is the *Longus*; it ariſeth by a fleſhy Beginning, three or four Fingers Breadth above the external Extuberance of the *Humerus*. It lies all along the *Radius*, to whoſe inferior and external Part it is inſerted by a pretty broad Tendon.

The ſecond is the *Brevis*; it cometh from the external and upper Part of the *Ulna*, and paſſing round the *Radius*, it is inſerted into its upper and fore Part, below the Tendon of the *Biceps*.

SECT. VIII.

Of the Muſcles of the Palm of the Hand, and of the Wriſt.

THE Muſcles of the Palm of the Hand are two.

The firſt is that which is commonly known by the Name of *Palmaris*; it ariſes from the internal Extuberance of the *Humerus*, and by a long and ſlender Tendon it paſſes above the *Ligamentum Annulare* to the Palm of the Hand, where it expands itſelf into a large *Aponeuroſis*, which cleaves cloſe to the Skin above, and to the Sides of the Bones of the *Metacarpus* below, and the firſt *Phalanx* of the Fingers, by which Means it makes four Caſes for the Tendons of the Benders of the Fingers to paſs through. This Muſcle is ſometimes, but the *Aponeuroſis* is always there.

The ſecond may be called *Palmaris Brevis*; it lies under the *Aponeuroſis* of the firſt; it ariſes from the Bone of the *Metacarpus* that ſuſtains the little Finger, and from that Bone of the *Carpus* that lies above the reſt. It goes tranſverſely, and is inſerted into the eighth Bone of the *Carpus*. The firſt aſſiſts the Hand to graſp any thing cloſely, and the ſecond makes the Palm of the Hand concave.

The Muſcles of the Wriſt are four, two internal for bending of it, and two external for extending it.

The firſt is the *Cubitæus Internus*; it ariſes from the internal Extuberance of the *Humerus* and upper Part of the *Ulna*, upon which it runs all along till it paſs under the *Ligamentum Annulare*, and is inſerted by a ſtrong and ſhort Tendon into the fourth of the firſt Order of the *Carpus*.

The ſecond is the *Radiæus Internus*, which comes from the ſame Part with the former, and, lying along the *Radius*, it is inſerted into the firſt Bone of the *Metacarpus* that ſuſtains the fore Finger. Theſe two Muſcles bend the Wriſt.

The third, which is the firſt of the Extenſors, is the *Cubitæus Externus*; it comes from the external Extuberance of the *Humerus*, and paſſing its Tendon under the *Ligamentum Annulare*, it is inſerted into the fourth Bone of the *Metacarpus* that ſuſtains the little Finger.

The fourth is the *Radiæus Externus* or *Bicornis*, which is two diſtinct Muſcles; the firſt ariſes from above the external Protuberance of the *Humerus*, and the ſecond from the lowermoſt Part of the external Protuberance. They both ly along the external Part of the *Radius*; they paſs under the Annular Ligament, and the one is inſerted into the Bone of the *Metacarpus* that ſuſtains the Fore Finger, the other to that which ſuſtains the middle Finger; theſe two extend the Wriſt.

SECT. IX.

Of the Muſcles of the Fingers.

THE Fingers are bended and extended, they are drawn to and from the Thumb by ſeveral Muſcles. The Muſcles which bend them are the *Sublimis* and the *Profundus*.

The *Sublimis*, otherwiſe called *Perforatus*, ariſes from the internal Protuberance of the *Humerus*, and from the upper and fore Part of the *Radius*: It divides into four Parts, which ſends four Tendons, which paſs under the Annular Ligament to be inſerted into the upper Part of the ſecond *Phalanx* of each of the four Fingers. Each of theſe Tendons, as they paſs the firſt Internode of the Fingers, have a Slit in their Middle, for the Paſſage of the Tendons of the *Profundus*, which lies under the *Sublimis*, it ariſeth fleſhy from the upper Part of the *Ulna*, and from the Ligament that joins this Bone to the *Radius*. The lower Part of its Body is outwardly tendinous; it divides into four round Tendons, which paſs under the Annular Ligament, and through the Slits of the former Tendons, to be inſerted into the third Bone of the Fingers.

The Muſcles have this in particular, that the Tendons of the uppermoſt give Paſſage to the Tendons of the lower: And their Tendons upon the Palm of the Hand are encloſed in Caſes from the *Aponeuroſis Palmaris*, and upon the Fingers in ſtrong membranous Caſes which are fixed to the Sides of each Finger.

The *Extenſor Digitorum Communis* ariſes from the external Protuberance of the *Humerus*, and at the Wriſt it divides into three flat Tendons, which paſs under the Annular Ligament, to be inſerted into all the Bones of the fore, middle, and Ring Finger. Theſe Tendons, near the firſt Internodes of the Fingers, give ſome tendinous Fibres to each other, and ſome alſo to the *Interoſſei.*

The *Lumbricales*, or *Vermiculares*, are ſmall Muſcles which riſe from the Tendons of the *Profundus*, and are inſerted into the firſt Internodes of each Finger. On their internal Sides next the Thumb they aſſiſt in bending the firſt Joint of the Fingers.

The *Interoſſei*, ſome reckon ſix, and others, more juſtly, eight; they are contained betwixt the Spaces of the Bones of the *Metacarpus:* The one Half of them lies betwixt the Spaces that theſe Bones leave towards the Palm of the Hand; they are the internal *Interoſſei;* they ariſe from the upper Part of the Bones of the *Metacarpus* next the *Carpus*, and they are inſerted on the internal Sides of the firſt Bones of the Fingers, with the *Lumbricales;* they are the *Abductores Digitorum*, for they bring the Fingers to the Thumb. The other Half are contained in the Spaces that the Bones of the *Metacarpus* leave on the Back of the Hand; they riſe from the upper Part of the Bones of the *Metacarpus* next the *Carpus*, and they are inſerted on the external Sides of the firſt Bones of the Fingers; and theſe are the *Ab-*

ductores Digitorum, for they draw the Fingers from the Thumb.

The Thumb is bended by two Muſcles. The firſt ariſes from the internal Extuberance of the *Humerus*, from the Middle and inner Part of the *Radius*, by two different Orders of fleſhy Fibres; and paſſing under the *Ligamentum Annulare*, its Tendon is inſerted into the third Bone of the Thumb. The ſecond ariſes from the Bones of the *Carpus*, from the Annular Ligament, and is inſerted into the ſecond Internode of the Thumb: Theſe two Muſcles are called *Flexores Pollicis*.

It is extended by three Muſcles, which are,

The *Extenſor primi Internodii Pollicis*. It ariſes from the upper and external Part of the *Ulna*; it paſſes obliquely over the Tendon of the *Radiæus Externus*, and is inſerted near the ſecond Joint of the Thumb.

The *Extenſor ſecundi Internodii Pollicis*. It ariſes from the upper and internal Part of the *Radius*, and is inſerted into the upper Part of the ſecond Bone of the Thumb.

The *Extenſor tertii Internodii Pollicis*. It ariſes from the *Ulna*, a little below the firſt *Extenſor*, and is inſerted into the third Bone of the Thumb.

The *Tenar* draws the Thumb from the Fingers; it makes that Part which is called *Mons Lunæ*; it ariſeth from the *Ligamentum Annulare*, and firſt Bone of the *Carpus*, and is inſerted into the external Side of the Thumb.

The *Antitenar* draws the Thumb to the

Fingers; it riſeth from the Bone of the *Metacarpus* that ſuſtains the fore Finger, and is inſerted into the firſt Bone of the Thumb.

The *Abductor Indicis* ariſes from the fore Part of the firſt Bone of the Thumb, and is inſerted into the Bones of the fore Finger; it draws this Finger to the Thumb.

The *Index* hath a particular *Extenſor*, which comes from the Middle and external Part of the *Ulna*; it paſſeth under the Annular Ligament, and is inſerted into the third Bone of the fore Finger, where it joins the *Extenſor Communis*.

The little Finger hath two proper Muſcles, the one draws it from the other Fingers, the other extends it. The firſt is called *Hypotenar*; it ariſeth from the fourth Bone of the ſecond Rank of the Bones of the *Carpus*, and from the *Ligamentum Annulare*, and is inſerted externally into the firſt Bone of the little Finger; this draws it from the other Fingers.

The *Extenſor* of the little Finger ariſes from the external Protuberance of the *Humerus*, and from the upper Part of the *Ulna*; it paſſes under the Annular Ligament, and is inſerted into the third Bone of the little Finger.

SECT. X.

Of the Muſcles of the Thigh.

THE Thigh is bended and extended, moved outwards and inwards, obliquely and circularly, by thirteen Muſcles.

It is bended by the *Pſoas*, *Iliacus*, and *Pectinæus*.

The *Pſoas* ariſes from the internal Side of the tranſverſe Proceſſes of the *Vertebræ* of the Loins, within the *Abdomen*; and deſcending upon Part of the internal Side of the *Ilium*, it is inſerted into the lower Part of the little *Trochanter*.

The *Iliacus* ariſes from the internal Cavity of the *Os Ilium*, and deſcending, it joins with the former, with which it is alſo inſerted.

The *Pectinæus* ariſes from the external Part of the *Os Pubis*, and is inſerted a little below the leſſer *Trochanter*.

The Thigh is extended by the *Glutæus Major*, *Medius* and *Minor*.

The *Glutæus Major* ariſes ſemi-circularly from the *Os Coccigis*, the Spines of the *Sacrum*, from the Spine of the *Ilium*, and from a ſtrong Ligament that runs between the *Sacrum* and *Tubercle* of the *Iſchium*; and deſcending, it is inſerted into the *Linea Aſpera*, four Fingers Breadth below the great *Trochanter*.

The *Glutæus Medius* ariſes from all the Spine of the *Ilium* under the former, and is inſerted into the ſuperior and external Part the *Trochanter*.

The *Glutæus Minor* ariſes from the lower Part of the external Side of the *Ilium*, under the former, and is inſerted at the ſuperior Part of the great *Trochanter*.

The Thigh is moved inwards, or they are both brought together by the *Tricops*, which hath three Originations, and three Inſertions, and may be divided into three Muſcles.

The firſt ariſes from the *Os Pubis*, and is inſerted above the ſecond in the *Linea Aſpera* in the Thigh-bone.

The ſecond ariſes from the lower Part of the *Os Pubis*, and is inſerted about the Middle of the *Linea Aſpera*.

The third ariſes from the *Os Pubis*, where it joins the *Os Iſchium*, and is inſerted from a little below the ſecond to the internal and lower *Apophyſis* of the Thigh-bone. When they act, they pull the Thigh-bone inwards, and turn it a little outwards.

The Thigh is turned outwards by the *Quadrigemini*.

The firſt is the *Pyriformis*, or *Iliacus Externus*; it riſes round and fleſhy from the inferior and lateral Part of the *Os Sacrum*, and is inſerted with

The ſecond and third, called *Gemini*, which ariſe from the Protuberance of the *Iſchium*, and are inſerted with the firſt in the Dent at the Root of the great *Trochanter*.

The fourth is the *Quadratus*; it comes from the Protuberance of the *Iſchium*, and is inſerted into the Outſide of the great *Trochanter*.

The Thigh is moved circularly and obliquely when theſe Muſcles act ſucceſſively, but particularly by the two *Obturatores*.

The *Obturator Internus* comes from the internal Circumference of the Hole that is between the *Iſchium* and *Pubis*; and paſſing through the Sinuoſity of the *Iſchium*, it is inſerted into the Dent of the great *Trochanter*.

Its Tendon lies between the *Gemini*; it turns the Thigh to the Outſide.

The *Obturator Externus* comes from the external Circumference of the ſame Hole as the former: It embraces the Neck of the Thigh-bone, and paſſes under the *Quadratus* to the ſmall Cavity of the great *Trochanter*.

SECT. XI.

Of the Muſcles of the Leg.

THE Leg is bended by four Muſcles, and extended by four others. The Muſcles which bend it are,

The *Semi-nervoſus*, which ariſes from the Protuberance of the *Iſchium*, and is inſerted by a round Tendon into the internal Part of the *Epiphyſis* of the *Tibia*.

The *Semi-membranoſus* ariſes tendinous from the Protuberance of the *Iſchium*, immediately below the former, and is inſerted by a large Tendon into the upper and back Part of the *Tibia*.

The *Biceps*, ſo called becauſe it has two Heads, of which one comes from the Tuberoſity of the *Iſchium*, the other from the Middle of the *Linea Aſpera*, both which join together, and are inſerted by one Tendon into the ſuperior and external Part of the *Perone*.

The *Gracilis* ariſes from the Union of the *Os Pubis* and *Iſchium*, and deſcending by the Inſide of the Thigh, it grows tendinous, and is inſerted into the ſuperior and internal Side of the *Tibia.*

The Leg is extended by four Muſcles, which are,

The *Rectus*; it ariſes from the lower Part of the Spine of the *Ilium*, and deſcending between the two following, it is inſerted with them.

The *Vaſtus Externus*, which comes from the Root of the great *Trochanter*, and Part of the *Linea Aſpera.*

The *Vaſtus Internus*, which ariſes from the Root of the leſſer *Trochanter.*

The *Cruræus*, which comes from the fore Part of the Thigh-bone, between the great and leſſer *Trochanter*; and lying cloſe upon the Bone, it joins its Tendon with the three former, which all together make one broad Tendon, which paſſes over the *Patella*, and is inſerted into the little Tuberoſity on the upper and fore Part of the *Tibia.*

The Leg is moved obliquely by three Muſcles.

The *Longus* or *Sartorius*; it ariſes from the inferior Part of the Spine of the *Ilium*, and running obliquely by the Inſide of the Thigh, is inſerted into the internal Side of the *Tibia*, three or four Fingers Breadth below its upper Extremity. By this Muſcle we throw one Leg and Thigh croſs another.

The *Poplitæus*; it ariſes from the external and inferior Protuberance of the Thigh-bone, and paſſing over the Joint obliquely, is inſerted into the ſuperior and internal Part of the *Tibia.* This aſſiſts in bending of the Leg, and turns it a little inwards.

The *Membranoſus*, or *Faſcia Lata*, which ariſes fleſhy from the fore Part of the Spine of the *Ilium*, and a little below it becomes membranous or tendinous, and covers almoſt all the Muſcles of the Thigh and Leg down to the Foot. This Muſcle helps in extending of the Leg, and turns the Leg a little outwards.

SECT. XII.

Of the Muſcles of the Foot.

THE Foot is bended by the *Tibialis Peronæus Anticus*.

The *Tibialis Anticus* ariſes fleſhy from the upper and fore Part of the *Tibia*, and adhering to the external Side of the *Tibia*, as it deſcends it paſſes under the *Ligamentum Annulare*, and is inſerted into the *Os Cuneiforme*, which anſwers to the great Toe.

The *Peronæus Anticus* is joined to the *Poſticus* at its Origination, which is from the upper and external Half the *Perone*; and running through the Channel which is in the external Ancle, it is inſerted into the *Os Metatarſi* that ſuſtains the great Toe.

The Foot is extended by four Muſcles.

The firſt and ſecond are the *Gaſterocnemius*, or *Gemellus*, which, with the *Soleus*, make the Calf of the Leg. The one ariſes from the back Part of the internal Protuberance of the Thigh-bone, the other from the ſame Part of the external Protuberance of the ſame Bone: They have two large fleſhy Bellies,

lies, which join and make one Tendon with the following, which is inſerted into the *Os Calcis.*

The third is the *Soleus,* which lies under the former; it ariſes from the upper and back Part of the *Tibia* and *Perone;* and deſcending, it joins its Tendon with the former. The Tendon of theſe three Muſcles is big and ſtrong, called *Tendo Achillis.*

The fourth is the *Plantaris;* it has a fleſhy Origination from the back Part of the external Protuberance of the Thigh-bone; and deſcending a little Way between the *Gemellus* and *Soleus,* it becomes a long and ſlender Tendon, which marches by the Inſide of the great Tendon, and at the Sole of the Foot is expanded into a large *Aponeuroſis,* which has the ſame Uſe, Situation and Connection, as that of the Palm of the Hand.

The Foot is moved ſideways by two Muſcles.

The *Tibialis Poſticus,* which ariſes from the ſuperior and back Part of the *Tibia* and *Fibula,* and Membrane that ties them together, and deſcending by the hind Part of the *Tibia,* paſſes through the Fiſſure of the inner Ancle, and is inſerted into the under Side of the *Os Naviculare;* it moveth the Foot inwards.

The *Peronæus Poſticus* ariſes from the ſuperior and external Part of the *Perone;* and deſcending, it paſſes through the Fiſſure of the external Ancle under the Sole of the Foot, to be inſerted into the *Os Metatarſi* that ſuſtains the little Toe. When this Muſcle acteth, it pulleth the Foot outwards.

SECT. XIII.

Of the Muſcles of the Toes.

THE four leſſer Toes are bended, and extended, and moved ſideways.

They are bended by the *Perforans* and *Perforatus.*

The *Perforans* ariſes from the upper and back Part of the *Tibia*, and paſſing under the inner Ancle and Ligament that ties the *Tibia* and *Os Calcis* together, it divides into four Tendons, which paſs through the Holes of the *Perforatus*, and are inſerted into the third Bones of each leſſer Toe. There is a *Maſſa Carnea* that ariſes from the *Os Calcis*, which joins the Tendons of this Muſcle where the *Lumbricales* begin.

The *Perforatus*, or *Flexor Brevis*, ariſes from the inner and lower Part of the *Os Calcis*, and is inſerted by four Tendons into the ſecond *Phalanx* of each Toe. Theſe Tendons are perforated, to give way to the Tendons of the *Perforans.*

The Toes are extended by the *Longus* and *Brevis.*

The *Longus* comes from the ſuperior and external Part of the *Tibia*, and from the upper Part of the *Fibula*; and, being divided into five Tendons, it paſſes under the *Ligamentum Annulare*, and is inſerted into the third Bones of the leſſer Toes, and into the *Os Metatarſi* that ſuſtains the little Toe.

The *Brevis* lies under the Tendons of the former, and ariſes from the external and fore Part of the *Os Calcis*, and is inſerted by five Tendons into the ſecond *Phalanx* of the Toes: Theſe Tendons cut the Tendons of the former at acute Angles.

The four *Lumbricales* ariſe from the Tendons of the *Perforans*, and are inſerted into the Inſide of the leſſer Toes.

The eight *Interoſſei*, which ly betwixt the Bones of the *Metatarſus*, have the ſame Situation, Uſe, Origination and Inſertion, as thoſe of the Hand.

The *Abductor Minimi Digiti* ariſes from the external Part of the *Os Calcis*, and lying upon the Outſide of the *Os Metatarſi*, that ſuſtains the little Toe, it is inſerted into the upper Part of the firſt Bone of the ſame Toe externally.

The great Toe is bended, extended, and moved ſideways by ſeveral Muſcles.

The *Flexor Pollicis Longus* ariſes from the upper and back Part of the *Fibula*, and, paſſing behind the inner Ancle, it is inſerted into the laſt Bone of the great Toe.

The *Flexor Pollicis Brevis*; it ariſeth from the *Os Cuneiforme medium*, and is inſerted into the *Oſſa Seſamoidæa* upon the ſecond Joint of the great Toe.

The *Extenſor Pollicis* ariſes from near the upper Half of the *Perone* forwardly; and paſſing under the *Ligamentum Annulare*, is inſerted into the laſt Bone of the great Toe.

The *Tenar*, or *Abducens Pollicis*, ariſes from the *Os Calcis*, and from the *Cuneiforme Majus*, and is inſerted into the external Side of the *Os Seſamoides*.

The *Antitenar*, or *Abductor Pollicis*, ariſes from the inferior Part of the third *Os Cuneiforme*, and, paſſing obliquely, is inſerted into the Inſide of the *Oſſa Seſamoidæa*.

The *Tranſverſalis* comes from the Bone of the *Metatarſus* that ſuſtains the Toe next the little Toe, and, paſſing a-croſs the other Bones, it is inſerted into the *Os Seſamoides* of the great Toe: Its Uſe is to bring all the Toes cloſe to one another.

A TABLE of the MUSCLES.

The *Muſcles of the* Fore-head *are one Pair.*	*Frontales,*	They pull the Skin of the Forehead upwards.
	Occipitales,	They pull the Skin of the Hindhead upwards.
Of the Hind-head *one Pair.*	*Attollens* *Deprimens* } *Auricularum.*	
Of the Ears *ſix Pair.*	*Internus Malleoli,*	It diſtends the *Tympanum.*
	Externus Malleoli.	It relaxes the *Tympanum.*
	Obliquus Malleoli.	
Of the Eye-brows *one Pair.*	*Muſculus Stapidis,*	It moves the Stirrup.
	Corrugator Supercilii.	
Eye-lids *two Pair.*	*Rectus Palpebræ Superioris,*	It lifts up the upper Eye-lids.
	Orbicularis Palpebrarum.	It ſhuts both Eye-lids.

Attollens

Attollens *Deprimens* *Abductor* *Adductor* *Oculorum.*		**Eyes *ſix Pair.***
Obliquus Major,	It pulls the Eye forwards, and obliquely downwards.	
Obliquus Minor,	It pulls the Eye forwards, and obliquely upwards.	
Attollens *Dilatans* *Deprimens* *Nares.*		**Noſe *three Pair.***
Inciſivus,	It pulls the upper Lip upwards.	**Lips *ſix Pair, and one ſingle one.***
Triangularis,	It pulleth it downwards.	
Caninus *Elevator Labii Inferioris,*	They pull the lower Lip upwards.	
Quadratus,	It pulleth it downwards.	
Zygomaticus,	It draws both Lips obliquely to either Side.	
Orbicularis,	It draws both Lips together.	
Buccinator,	It thruſts the Meat between our Teeth.	***Of the* Cheeks *one Fair.***
Temporalis, *Maſſeter,*	They pull the Jaw upwards.	
Pterigoidæus Internus,	It draws the Jaw to either Side.	**Lower Jaw *ſix Pair.***
Pterigoidæus Externus,	It draws the Jaw forwards.	

	Quadratus,	It pulleth the Jaw and the Cheeks downwards.
Uvula *two Pair.*	*Digaſtricus,*	It pulleth the Jaw downwards.
	Periſtaphylinus Internus,	It pulls the *Uvula* forwards.
	Periſtaphylinus Externus,	It pulls the *Uvula* backwards.
Tongue *three Pair.*	*Stylogloſſus,*	It draws the Tongue upwards.
	Geniogloſſus,	It pulls it out of the Mouth.
	Ceratogloſſus,	It pulls it into the Mouth.
Os Hyoides *five Pair.*	*Genihyoidæus,*	It pulls *Os Hyoides* and Tongue upwards and forwards.
	Sternohyoidæus,	It pulleth the *Os Hyoides* downwards.
	Mylohyodæus,	It pulls it obliquely upwards.
	Coracohyoidæus,	It pulls it obliquely downwards.
	Stylohyoidæus,	It pulls it to either Side, and ſomewhat upwards.
Of the **Pharynx,** *two Pair.*	*Stylo-Pharyngæus,*	It pulleth up and dilateth the *Pharynx.*
	Oeſophagus,	It ſtraitens the *Pharynx.*
Larynx, *ſeven Pair.*	*Sternothyroidæus*	It pulls the *Thyroides* downwards.
	Thyothyroidæus,	It pulls the *Thyroides* upwards.
	Cricothyroidæus.	

Cricoarytænoidæus Poſticus.		
Cricoarytænodiæus Lateralis.		
Thyroarytænoidæus,	It dilates the *Glottis*.	
Arytænoidæus,	It contracts the *Glottis*.	
Splenius,	They move the Head backwards.	**Head, two** *Pair.*
Complexus,		
Rectus Major,	They nod the Head backwards.	
Rectus Minor,		
Obliquus Inferior,	They perform the Semi-circular Motion of the Head.	
Obliquus Superior,		
Maſtoidæus,		
Rectus Internus Major,	They nod the Head forwards.	
Rectus Internus Minor,		
Rectus Lateralis,	It nods the Head to one Side.	
Intercoſtales Interni & Externi,	They pull the Ribs upwards in Inſpiration.	**Of the Thorax, twenty-nine** *Pair.*
Subclavius,		
Serratus Anticus, Major,		
Serratus Poſticus, Superior,		
Triangularis,		
Serratus Poſticus Inferior,	They make the Motion of the Ribs downwards, in Expiration, the ſwifter.	
Sacrolumbaris,		
Diaphragma,	It Uſe is both in Inſpiration, and Expiration.	

Lower Belly, *five Pair.*	*Obliquus Externus,* *Obliquus Internus,* *Tranſverſalis,* *Rectus,* *Pyramidalis,*	They compreſs all the Parts contained in the Lower Belly; aſſiſt the Motion of the Ribs downwards in Expiration, and help to bend the *Vertebræ* of the Loins forwards.
Of the Vertebræ, *ſeven Pair.*	*Longiſſimus Dorſi,*	It keeps the Body erect.
	Tranſverſalis Dorſi,	It moves the Body obliquely backwards.
	Interſpinalis,	It draws the acute Proceſſes nearer one another.
	Quadratus Lumborum,	It draws the *Vertebræ* of the Loins to one Side.
	Longus, *Scalenus,*	They bend the *Vertebræ* of the Neck.
	Pſoas Parvus,	It helps to bend the *Vertebræ* of the Loins.
The Muſcles of the Privities in Men, are four Pair.	*Cremaſter,*	It draws up the Teſticles in the Act of Generation.
	Erectores Penis	
	Tranſverſalis Penis,	
	Acceleratores Urinæ,	
Clitoris, one Pair,	*Erectores Clitoridis,*	

Sphincter Veſicæ,	It contracts the Neck of the Bladder, that the Urine may not run continually.	*One ſingle Muſcle of the Bladder.*
Levatores Ani,	They draw up the *Anus.*	*Of the* Anus *three ſingle Muſcles.*
Sphincter Ani.	It ſhuts the *Anus.*	
Serratus Anticus Minor,	It draws the Shoulder-Blade forwards.	*Of the* Shoulder-Blades.
Trapezius,	It moves it upwards, backwards, and downwards.	
Rhomboides,	It pulls it backwards.	
Levator Scapulæ,	It pulls the Shoulder-Blade upwards.	
Deltoides,	They lift the Arm upwards.	*Of the* Shoulder Bones, *nine Pair.*
Supra Spinatus,		
Coracobrachialis,		
Teres Major,	They pull the Arm downwards.	
Latiſſimus Dorſi,		
Pectoralis,	It moves the Arm forwards.	
Infra Spinatus,	They draw the Arm backwards.	
Tranſverſalis,		
Subſcapularis,		
Biceps,	They bend the fore Arm.	Cubiti, *ſix Pair.*
Brachiæus Internus,		
Longus,	They extend the fore Arm.	
Brevis,		
Brachiæus Externus,		
Anconæus,		

Of the Radii, *four Pair.*	Rotundus,	They perform the Motion of *Pronation,* or they turn the Palm of the Hand downwards.
	Quadratus,	
	Longus,	They perform the Motion of *Supination,* or they turn the Palm of the Hand upwards.
	Brevis,	
Wriſts, *four Pair.*	*Cubitæus Internus,*	They bend the Wriſt.
	Radiæus Internus,	
	Cubitæus Externus,	They extend the Wriſt.
	Radiæus Externus,	
Of *the* Palms *of the Hands, two Pair.*	*Palmaris,*	It helps the Hand to graſp any Thing cloſely.
	Palmaris Brevis,	It makes the Palm of the Hand concave.
Of *the* Fingers, *fifteen Pair.*	*Sublimis,*	They bend the Fingers.
	Profundus,	
	Extenſor Digitorum Communis,	
	Lumbricales,	They aſſiſt in bending the firſt Joint of the Fingers.
	Interoſſei Interni,	They draw the Fingers to the Thumb.
	Interoſſei Externi,	They draw the Fingers from the Thumb.
The particular Muſcles of the Thumbs *are ſeven Pair.*	*Flexor Pollicis Longus,*	
	Flexor Pollicis Brevis,	
	Extenſor Primi,	
	—— *Secundi,*	
	—— *Tertii Internodii, Pollicis,*	

Tenar,

Tenar,	It draws the Thumb from the Fingers.	
Antitenar,	It draws the Thumb to the Fingers.	
Abductor Indicis, *Extenſor Indicis,*		*Of the Fore-fingers, two.*
Hypotenar,	It draws the little Finger from the reſt.	
Extenſor Auricularis,		*Of the Little Fingers, two Pair.*
Pſoas, *Iliacus,* *Pectinæus,*	They bend the Thigh.	
Glutæus Major, *Glutæus Medius,* *Glutæus Minor,*	They extend the Thigh.	*The Muſcles of the Thigh are thirteen Pair.*
Triceps,	It pulls the Thigh inwards.	
Pyriformis, *Gemini,* *Quadratus,*	They move the Thigh outwards.	
Obturator Internus, *Obturator Externus,*	They help to move the Thigh obliquely, and circularly.	
Semi-nervoſus, *Semi-membranoſus,* *Biceps,*	They bend the Leg.	*Of the Leg, eleven Pair.*
Gracilis,		
Rectus,		
Vaſtus Externus, *Vaſtus Internus,* *Cruræus,*	They extend the Leg.	
Sartorius,	It makes the Legs croſs one another.	
Poplitæus,	It turns the Leg ſomewhat inwards.	

Mem-

	Membranoſus,	It turns it a little outwards.
Of the Feet, eight Pair.	*Tibialis Anticus*	They bend the Foot.
	Peronæus Anticus,	
	Gaſtroenemii,	They extend the Foot.
	Soleus,	
	Plantaris,	
	Tibialis Poſticus,	It moveth the Foot inwards.
	Peronæus Poſticus,	It moveth the Foot outwards.
Of the Toes, twenty four Pair:	*Profundus,*	They bend the four leſſer Toes.
	Sublimis,	
	Lumbricales,	
	Longus,	They extend the four leſſer Toes.
	Brevis,	
	Flexor Pollicis.	
	Extenſor Pollicis.	
	Tenar,	It draws the great Toe from the reſt.
	Antitenar,	It draws it to the reſt.
	Flexor Pollicis Longus,	
	——Brevis,	
	Abductor Minimi Digiti,	
	Interoſſei Interni,	They draw the Toes to the great Toe.
	Interoſſei Externi,	They draw them from the great Toe.
	Tranſverſalis,	It brings all the Toes cloſe to one another.

In all 446 ſingle Muſcles in the Body.

CHAP.

CHAP. VII.

Of the Nerves, Veins and Arteries.

SECT. I.

Of the Nerves in general.

A Nerve is a long and ſmall Bundle of very fine Pipes, or hollow Fibres, wrapt up in the *Dura* and *Pia Mater*; which laſt not only covers them all in common, but it alſo encloſes every Fibre in particular.

The Medullary Subſtance of the Brain is the Beginning of all the Nerves; and it is probable that each Fibre of the Nerves anſwers to a particular Part of the Brain at one End, and to a particular Part of the Body at its other End, that whenever an Impreſſion is made upon ſuch a Part of the Brain, the Soul may know, that ſuch a Part of the Body is affected.

The Nerves do ordinarily accompany the Arteries through all the Body, that the Animal Spirits may be kept warm, and moving by the continual Heat and Pulſe of the Arteries. They have alſo Blood-Veſſels as the other Parts of the Body: Theſe Veſſels are not only ſpread upon their Coats, but they run alſo amongſt their Medullary Fibres, as may be ſeen amongſt the Fibres of the *Retina*. Where-ever any Nerve ſends out a Branch, or receives one from another, or where two Nerves join together, there is generally a *Ganglio* or *Plexus* either leſs or more, as may be ſeen at the Beginning of all Nerves of the *Medulla Spinalis*, and in many other Places of the Body.

SECT. II.

Of the Nerves which come immediately out of the Skull.

THE Nerves are divided into thoſe which come immediately out between the *Vertebræ*. The firſt Sort come from the *Medulla Oblongata*, which has been already deſcribed, and they are ten Pair.

Nervi Olfactorii. The firſt Pair are called *Nervi Olfactorii*; they ariſe from the Baſis of the *Corpora Striata*, and paſſing through the little Holes of the *Os Cribriforme*, they are ſpread upon the Membrane which covers the *Os Spongioſum*.

Optici. The ſecond are called *Optici*; they riſe partly from the Extremities of the *Corpora Striata*, and partly from the *Thalami Nervorum Opticorum*, which laſt they almoſt embrace; from thence approaching one another, they unite above the *Cella Turcica*, and immediately dividing again they paſs through the formoſt Holes of the *Os Sphænoides* into the Orbit, where piercing the Globe of the Eye, their Medullary Fibres are ſpread upon the glaſſy Humour.

Oculorum Motores. The third are called *Oculorum Motores*; they ariſe from the *Medulla Oblongata* on each Side of the *Infundibulum*, and the Carotidal Arteries ly between them; from thence paſſing through the *Foramina Lacera* of the *Os Sphænoides*, they give a Branch, which, with a Branch of the fifth Pair, forms a conſiderable *Plexus*, which ſends out ſeveral Twigs which embrace the Optick Nerve, and are ſpent on the Tunicles of the Eye: They give a Branch to the Muſcles called *Attollens*, *Deprimens* and *Obliquus Minor* of the Globe.

Pathetici. The fourth Pair are called *Pathetici*; they ariſe from a ſmall Medullary Cord that is behind the *Teſtes*; they go down upon the Sides of the *Medulla Oblongata*, and paſſing under the *Dura Mater* by the Sides of the *Cella Turcica*, they go through the *Foramen Lacerum*, and are wholly ſpent on the *Obliquus Major*.

The fifth Pair. The fifth Pair riſe from the fore Part of the *Proceſſus Annularis*; they are the biggeſt Pair of the Brain; they give Nerves to the *Dura Mater*; each of them divides into three Branches, of which the foremoſt is called *Ramus Ophthalmicus*, becauſe it paſſes thro' the *Foramen Lacerum* into the Orbit, where it divides into two Branches. The firſt ſends out a Branch which joins a Branch of the *Motores*, and forms the *Plexus Ophthalmicus*; the reſt of this firſt Branch paſſes over the Globe of the Eye, gives ſome Twigs to the *Glandula Lachrymalis*, and goes out at the Hole of the *Os Frontis* above the Circumference of the Orbit, where it is diſtributed in the Skin and Frontal Muſcles. The ſecond Branch of the *Ramus Ophthalmicus* goes under the Muſcle *Superbus*, and paſſes out at the

Hole called *Orbiter Internus*, and is diſtributed in the internal Noſe.

The ſecond Branch of the fifth Pair, which paſſes out of the third Hole of the *Os Sphenoides*, divides into three Branches, of which one pierces the hind Side of the *Os Maxillare*, and gives Twigs to the Teeth of the upper Jaw; all the reſt of it comes out at the Hole in the fore Side of the ſame Bone, under the Orbit, and is diſtributed into the Cheeks and Noſe. Another paſſes under the *Proceſſus Zygomaticus*, and is diſtributed in the Temporal Muſcle; and the third is diſtributed in the Palate and Muſcles of the *Pharynx*.

The third Branch of the fifth Pair paſſes through another Hole of the *Os Sphenoides*, and then it divides into two Branches; the firſt of which is again divided into four Branches, of which the firſt paſſes between the Condyle and the *Corone* of the lower Jaw, to the *Maſſeter*. The ſecond is diſtributed in the *Crotaphites*. The third paſſes under the *Proceſſus Zygomaticus* to the *Buccinator*, Glands of the Cheeks, and upper Lip. And the fourth paſſes from behind the Condyle of the lower Jaw, where it joins the *Portio Dura* over the Jaw, and is diſtributed in the Face. The ſecond Branch is divided into three others. The firſt paſſes between the *Pterigoidæus Externus* and the *Internus*; and towards the Angle of the lower Jaw it ſends out a Branch which makes the *Chorda Tympani*, which goes alſo to the Muſcles of the *Malleolus*, and then it joins the *Portio Dura* before it comes out of the *Cranium*; the reſt is ſpread on the Chin. The ſecond goes along the Sides of the Tongue, and ſends out ſeveral Branches which join the ninth Pair. It gives alſo ſome Twigs to the *Glandulæ Sublinguales*, to the Muſcles of the Tongue and *Os Hyoides*. The third goes to the Teeth of the lower Jaw by the Holes in its Inſide.

The ſixth Pair.

The ſixth Pair of Nerves ariſe from the Sides of the *Proceſſus Annularis*. This is a ſmall Nerve which paſſes ſtraight through the the *Foramen Lacerum*, and is wholly ſpent on the *Muſculus Abducens*. But a little before it enters the Orbit, it caſts back a Branch which alone makes the Root of the Intercoſtal Nerve. It paſſes out of the Skull by the ſame Paſſage the Carotidal Artery enters. As ſoon as it is come out of the Skull, it, with a Branch of the tenth Pair, and of the firſt and ſecond of the *Vertebræ* of the Neck, forms a large *Plexus* called *Cervicalis*. Below this, it receives a Branch made of a Twig of the tenth Pair, and of the firſt of the Neck. As it deſcends, above the *Muſculus Scalenus*, and below the eighth Pair, it receives a Branch from each of the Vertebral Nerves. When it comes to the *Clavicula*, it divides into two Branches, of which one paſſes above the Axillary Artery, and the other under it, and then they immediately join again: They, with a Branch of the firſt Pair of the Back, form a pretty large *Plexus* at this Place; and ſometimes before (for it obſerves no Regularity) it caſts out a Branch, which with a Branch of the eighth Pair forms the *Plexus Cardiacus*; then it goes down the Cavity of the *Thorax*, under the *Pleura* near the *Vertebræ*, and as it paſſes by, it receives a Branch from every Pair of the Back, by which it grows bigger and bigger. As it goes out of the *Thorax* it divides into ſeveral Branches, of which the three ſuperior in the right Side form the *Plexus Hepaticus*, and in the left the *Plexus Splenicus*. Theſe *Plexus*'s furniſh Nerves to the Kidneys, to the *Pancreas* to the Caul, to the lower Part of the Stomach, to the Spleen, to the Liver, to the Meſentery, to the Inteſtines; and their Branches form a large Net upon the Meſenterick Arteries, called *Plexus Meſentericus*. The inferior Branches, as they go down upon the *Vertebræ* of the Loins, receive a Branch from the firſt of the Loins, and they ſend out Branches which join thoſe of the ſuperior Branches which go to the Guts, and which form the Net upon Meſenterick Arteries. Then they go down into the Baſon, and form a large *Plexus* above the ſtraight Gut, to which it gives Nerves, as alſo the Bladder, *Veſiculæ Seminales*, *Proſtatæ* in Men, and to the Womb and *Vagina* in Women.

Nervus Auditorius.

The ſeventh Pair is the *Nervus Auditorius*; it ariſes from the hind Part of the *Proceſſus Annularis*; it enters the Hole in the inner Proceſs of the *Os Petroſum*; it divides into two Branches; that which is ſoft is called *Portio Mollis*, and it is diſtributed into the Labyrinth *Cochlea*, and Membranes which cover the Cavities of the Ear. That which is hard, is called *Portio Dura*; it goes out of the Ear by that Hole which is between the *Proceſſus Maſtoides* and *Styloides*, it divides into two

Branches, of which one goes to the Muſcles of the Tongue, or *Os Hyoides*, and it gives a ſmall Branch to the eighth Pair. The other is diſtributed in the external Ear, Noſe, Lips, and Cheeks.

Par Vagum.

The eighth Pair is the *Par Vagum*; it riſes from the Sides of the *Medulla Oblongata*, behind the *Proceſſus Annularis*, by ſeveral Threads which join together, and go out by the ſame Hole that the *Sinus Laterales* diſcharge themſelves into the *Jugulares*. It is joined by a Branch of the *Nervus Spinalis*, or *Acceſſorius Williſii*, and by a ſmall Branch of the *Portio Dura*: Immediately after it comes out of the Skull, it gives a ſmall Branch to the *Larynx*, as it goes down the Neck, above the intercoſtal Nerve, by the Side of the Internal Carotide. At the Axillary Artery it caſts back the recurrent Nerves, of which the right embraces the Axillary Artery, and the left the *Aorta*. Theſe two Branches aſcend on each Side of the *Trachea Arteria* to the *Larynx*, where they are ſpent on the Muſcles of the *Larynx* and Membranes of the *Trachea*.

Then the eighth Pair, after it has entered the Cavity of the *Thorax*, ſends out two Branches, which, with the Branches of the two Intercoſtals, form, a little above the Heart, between the *Aorta* and the *Trachea*, the *Plexus Cardiacus*, which gives a great Number of ſmall Branches of the *Pericardium* and Heart, particularly very many creep along the *Aorta* to the left Ventricle. The eighth Pair gives alſo ſeveral Branches to the Lungs, which accompanying the *Bronchi*,

chi, then it deſcends upon the *Oeſophagus*, and is ſpread upon the Stomach; and ſome Twigs go to the concave Side of the Liver, as has been ſaid already.

With this Nerve it is uſual to deſcribe another which paſſes out of the Skull at the ſame Hole with it. It is called *Nervus Acceſſorius Williſii*; it ariſes from the *Medulla Spinalis*, about the Beginning of the ſixth Pair of the Neck; as it aſcends to the Head, it receives on each Side a Twig from the firſt five Pair of Nerves of the Neck, as they riſe from the *Medulla Spinalis*; then it enters the Skull, and paſſes out of it again with the eighth Pair, and is wholly ſpent upon the *Muſculus Trapezius*.

The ninth Pair.

The ninth Pair riſes from the *Proceſſus Olivares* of the *Medulla Oblongata*; it paſſes out of the Skull by its own proper Hole in the *Os Occipitis*: As it paſſes to the Tongue, it gives ſome Branches to the Muſcles of the *Os Hyoides*; but its Trunk is diſtributed in the Body of the Tongue, and its Extremities from the *Papillæ Rotundæ* of the Tongue.

The tenth Pair.

The tenth Pair riſes by ſeveral ſmall Threads from the Beginning of the *Medulla Spinalis*; then, aſcending a little, it goes out of the ſame Hole of the *Dura Mater* at which the Vertebral Artery enters, paſſing between the Protuberance of the *Occiput* and the firſt *Vertebra*, in the *Sinus*, which we have obſerved in this *Vertebra*. Then it gives a Branch to the firſt Pair of the Neck which goes to the *Plexus Cervicalis*; it gives the ſecond Pair, and a third to the Intercoſtal

Nerve; and then it is all ſpent on the oblique Muſcles of the Head.

S E C T. III.

Of the Nerves which come out between the Vertebræ.

THE Nerves which come out between the *Vertebræ* are thirty Pair; they ariſe from the *Spinalis Medulla* which (as we have ſaid before) is a Continuation of the *Subſtantia Medullaris*, or *Medulla Oblongata* of the Brain contained in the great Holes of the *Vertebræ*. Its internal Subſtance is mixed in ſeveral Places with a Subſtance like the Cortical Subſtance of the Brain, (as *Malpighius* has obſerved.) From the firſt *Vertebra* of the Neck to the firſt of the Loins, it is divided by the *Pia Mater* into the right and left Side, not quite through its Middle, but the Depth of a Line or two in its fore and hind Part. From the firſt of the Loins to its Extremity, it is divided into a great Number of Fibres, which ſeparate from one another, if they be ſhaken in warm Water. This Part, becauſe of its Reſemblance, is called *Cauda Equina*; it is covered by four Membranes, of which the firſt is that which lines the great Holes of the *Vertebræ*. The ſecond is the *Dura Mater*, which has two *Sinus's*, one on each Side of the *Medulla*; they reach from the *Occiput* to the laſt of the *Os Sacrum*. The third is the *Pia Mater*: And the fourth, called *Arachnoides*, is a very fine Membrane, which contains only the Bundles of Fibres which make the Vertebral Nerves.

All the Nerves, as they riſe out of the *Medulla Spinalis*, are by the *Pia Mater* divided into two Plans, which ly one above the other. And as ſoon as the Nerves are come out of the *Vertebræ*, they ſend a Branch to one another, where they make a little *Ganglio*.

The Nerves of the *Vertebræ* are thirty Pair, ſeven of the Neck, twelve of the Back, five of the Loins, and ſix of the *Os Sacrum*; they come out at the Holes in the Sides of the Bodies of the *Vertebræ*, which have been taken Notice of in the *Oſteology*.

Of the Nerves of the Neck. The firſt Pair of the Neck is ſpread in the Muſcles of the Head and Neck; it joins a Branch of the tenth Pair which goes to the *Plexus Cervicalis*, and it gives another Branch to the Intercoſtal Pair below the *Plexus*.

The ſecond Pair of the Neck gives alſo Nerves to the Muſcles of the Head and Neck, to the external Ear and Skin of the Face.

The third gives ſome Branches to the Neck and Head; it ſends out the *Nervus Diaphragmaticus*, being joined by a Branch from the fourth Pair. This Nerve goes ſtraight down the Cavity of the *Thorax*, and is ſpread on the Midriff.

The fourth, fifth, ſixth, and ſeventh give ſome Branches to the Muſcles of the Neck and Head; but their greateſt Branches, together with a Branch of the firſt of the Back, enter the Arms. As ſoon as they enter, they join all together, and then they immediately divide into five Branches. The firſt and innermoſt goes all to the Skin which covers the inner and fore Part of the Arm. The ſecond goes down by the inner Protuberance of the *Humerus*, by the Benders of the Fingers; and in the Palm of the Hand it divides into five Branches, of which one goes to each Side of the Little and Ring-Finger, and the fifth to the external Side of the middle Finger. The third accompanies the Artery between the *Sublimis* and the *Profundus*; it divides alſo into five Branches, of which one goes to each Side of the Thumb and fore Finger, and the fifth to the internal Side of the middle Finger. The fourth paſſes under the *Biceps* to the outer Side of the Arm, and Back of the Hand, to be diſtributed into the Fingers, as the foregoing. The fifth is ſpent on the Muſcles on the Inſide of the Arm. All theſe Nerves, except the firſt, give Branches to the Muſcles as they paſs by.

Of the Nerves of the Back.

The firſt Pair of the twelve Pair of the Back gives a Branch (as is ſaid) to the Arms. The twelfth Pair is diſperſed in the Muſcles of the Lower Belly, and all the reſt run along the *Sinus* in the under Side of the Rib, giving Nerves to all the Muſcles that ly upon the Ribs and *Vertebræ*.

Of the Nerves of the Loins.

The firſt and ſecond Pair of the Loins give Nerves to the Muſcles of the Lower Belly, to the *Inguen*, to the Yard, and to the Parts contained in the Baſon. The third and fourth, give ſome Branches to the ſame Parts; but their Trunks join, and make the *Nervus Anterior Femoris*, which is diſperſed in the fore Part of the Thigh. This Nerve ſends a Branch through the Hole in the *Iſchium*, which is ſpent in the *Triceps*. The laſt of the Loins, with a Branch of the fourth, enter the Thigh.

Of the Nerves of the Os Sacrum.

The Nerves of the *Os Sacrum* come not out at the Holes on its Backſide, but at thoſe on its Foreſide; and the laſt comes out between the Extremity of the *Os Sacrum* and the *Os Coccigis*.

The firſt four Pair of the *Os Sacrum* gives ſome Twigs to the Parts in the Baſon; but their great Branches, with the laſt, and a Branch of the fourth of the Loins, make the *Nervus Sciaticus*, which is the greateſt Nerve in the whole Body. As this Nerve paſſes between the *Gracilis Poſterior* and the *Semimembranoſus*, it gives a Branch to the Skin. When it comes to the Ham, it divides into two, of which one goes along the *Perone* to the upper Part of the Foot, and gives a Branch to both Sides of each Toe; the other paſſes under the *Gemelli* by the inner Ancle, and is diſtributed in like manner to the Toes in their under Sides.

The fifth and ſixth of the *Os Sacrum* are very ſmall, they are diſperſed in the Sphincter and Bladder and natural Parts.

SECT. IV.

Of the Arteries in general.

THE *Arteries* are Conical Channels which convey the Blood from the Heart to all the Parts of the Body.

Each Artery is compoſed of three Coats, of which the firſt ſeems to be a Web of fine Blood-Veſſels and Nerves, for the nouriſhing of the Coats of the *Artery*. The ſecond is made up of Circular, or rather Spiral Fibres, of which there are more or fewer *Strata*, according to the Bigneſs of the Artery. Theſe Fibres have a ſtrong Elaſticity, by which they contract themſelves with ſome Force, when the Power by which they have been ſtretched out ceaſes. The third and inmoſt Coat is a fine, denſe, tranſparent Membrane, which keeps the Blood within its Channels, which, otherwiſe, upon the Dilatation of the Artery, would eaſily ſeparate the Spiral Fibres from one another. As the Arteries grow ſmaller and ſmaller, ſo theſe Coats grow thinner, and the Coats of the Veins ſeem to be only a Continuation of the Coats of the Capillary Arteries.

The Structure of the Arteries being thus premiſed, it will be eaſy to account for their Pulſe. When the left Ventricle of the Heart contracts and throws its Blood into the great Artery, the Blood in the Artery is not only thruſt forwards towards the Extremities, but the Channel of the Artery is likewiſe dilated; becauſe Fluids, when they are preſſed, preſs again to all Hands, and their Preſſure is always perpendicular to the Sides of the containing Veſſels; but the Coats of the Artery, by any ſmall *Impetus*, may be diſtended; therefore, upon the Contraction of the Heart, the Blood from the left Ventricle will not only preſs the Blood in the Artery forwards, but both together will diſtend the

Sides of the Artery. When the *Impetus* of the Blood againſt the Sides of the Artery ceaſes, that is, when the left Ventricle ceaſes to contract, then the Spiral Fibres of the Artery, by their natural Elaſticity, return again to their former State, and contract the Channels of the Artery, till it is again dilated by the Syſtole of the Heart. This Diaſtole of the Artery is called its Pulſe, and the Time the Spiral Fibres are returning to their natural State, is the Diſtance between two Pulſes. This Pulſe is in all the Arteries of the Body at the ſame Time; for whilſt the Blood is thruſt out of the Heart into the Artery, the Artery being full, the Blood muſt move in all the Arteries at the ſame Time; and becauſe the Arteries are Conical, and the Blood moves from the *Baſis* of the Cone to the *Apex*, therefore the Blood muſt ſtrike againſt the Sides of the Veſſels, and conſequently every Point of the Artery muſt be dilated at the ſame Time that the Blood is thrown out of the left Ventricle of the Heart; and as ſoon as the Elaſticity of the Spiral Fibres can overcome the *Impetus* of the Blood, the Arteries are again contracted. Thus there are two Cauſes, which, operating alternately, keep the Blood in a continual Motion, *viz.* the Heart and Fibres of the Arteries: But becauſe the one is ſtronger than the other, therefore, tho' the Blood runs continually, yet when an *Artery* is opened it is ſeen to move *per Saltum*.

SECT. V.

Of the Trunk of the Aorta Aſcendens.

AS all the Blood of the Body paſſes thro' the Heart, ſo all is conveyed by the Branches of the *Aorta*, or great Artery, to the ſeveral Parts of the Body, in the Order we are now to deſcribe.

The *Aorta*, coming from the left Ventricle of the Heart, ſends out two Branches called *Coronariæ* to the Heart, before it pierces the *Pericardium*; but, after it hath pierced it, it aſcends a little, and then it crooks downwards and forms the *Aorta Deſcendens*. From the upper Side of this Crook it ſends out three Branches, two on the left Side, which are one Subclavian and one Carotide; one on the right Side, which is the right Subclavian, from which immediately ariſes the right Carotide.

The *Arteriæ Subclaviæ* on each Side ſend out the *Mediaſtina*, the *Mammaria*, the *Cervicalis* or *Vertebralis*; and a Branch which goes to the Muſcles of the Neck, of the Breaſt, and to the *Glandulæ Thyroides*. After the *Subclavian* has paſſed through the *Muſculus Scalenus*, it is called *Axillaris*.

The *Arteriæ Carotides*, as they aſcend on each Side of the *Trachea Arteria*, give ſome ſmall Branches to the *Trachea Arteria*, to the *Larynx*, to the *Glandulæ Thyroides*; and then they ſend out each four conſiderable Branches.

The firſt goes to the Tongue, to the

Muſcles of the *Os Hyoïdes*, and to the *Pharynx*.

The ſecond divides into two Branches, of which the firſt loſes itſelf in the Muſcles *Milohyoides* and *Digaſtrici*, and the ſecond goes along the Baſis of the lower Jaw, and is loſt in the Muſcles of the Lips.

The third Branch divides at the Angle of the lower Jaw into two Branches; one enters into the lower Jaw, and the other makes the *Arteria Temporalis*.

The fourth Branch goes to the Muſcles on the hind Part of the Neck, and to the Skin of the hind Head.

The Carotide then paſſes through the Canal in the *Os Petroſum*, gives ſome Branches to the *Dura Mater*, joins with the *Cervicalis*, ſends out Branches to the *Glandula Pituitaria*, *Rete Mirabile*, *Plexus Choroides*; then it runs through all the Circumvolutions of the *Cerebrum* and *Cerebellum*, and loſes its Capillary Branches in their Carotidal Subſtance.

The *Axillaris*, having pierced the *Scalenum*, gives ſome little Branches to the neareſt Muſcles; it ſends out the *Thoracica Superior* and *Inferior*, the *Scapularis*; and then it gives a Branch which paſſes under the Head of the *Humerus* into the *Muſculus Longus* and *Brevis* of the Arm.

The Trunk of the *Axillaris* goes down the Inſide of the Arm, giving Branches by the Way to the Muſcles that ly upon the *Humerus*. Above the Elbow it ſends out a Branch which is ſpread upon the internal Condyle of the *Humerus*.

At the bending the Elbow this ſame Trunk divides into two Branches, the one external, and the other internal.

The external runs along the *Radius*, it caſts out a Branch which goes to the *Supinator*, and aſcends to the *Brachialis Internus;* in the reſt of its Courſe down to the Wriſt, it gives Branches to the *Longus Rotundus*, and Benders of the Fingers, Wriſt and Thumb. Being come to the Wriſt, it ſends out a Branch which goes to the Beginning of the *Tenar*, then it paſſes under the Tendon of the *Flexor Pollicis;* it gives Branches to the external Part of the Hand, and paſſing under the Tendons of the Muſcles, its Branches run along each Side of the Thumb and fore Finger.

The internal Branch goes down along the *Cubitus* to the Wriſt, and is diſtributed in like manner to each Side of the Middle-finger, Ring-finger, and Little-finger.

SECT. VI.

Of the Aorta Deſcendens.

THE *Aorta Deſcendens* ſends out firſt the *Bronchialis* of M. *Ruyſch*, which accompanies all the Branches of the *Bronchia*. As it deſcends along the *Vertebræ* of the *Thorax*, it ſends out on each Side the Intercoſtal Arteries. To the *Diaphragma* it gives the *Phrenica;* and the *Cæliaca* is the firſt it ſends out when it enters the *Abdomen*. The *Cæliaca* divides into two Branches, the one on the right, the other on the left; of which the firſt gives the *Gaſtrica Dextra* which goes to the Stomach, the *Cyſticæ* to the Gall-Bladder, the *Epiplois Dextra* to the *Omentum*, the *Inteſtinalis* to the Inteſtine *Duodenum*, and to a Part of the *Jejunum*, the *Gaſtro-Epiplois* to the Stomach, to the *Omentum*, and ſome Branches to the Liver, which enter the *Capſula Communis*, to accompany the Branches of the *Vena Portæ*.

The left Branch of the *Cæliaca* gives the *Gaſtrica Dextra*, which is alſo ſpread on the Stomach, the *Epiplois Siniſtra* to the *Omentum*, and the *Splenica* to the Subſtance of the Spleen.

Then the *Aorta Deſcendens* ſends out the *Meſenterica Superior*, the *Renales* or *Adipoſæ*, which go to the *Glandulæ Renales*, and Fat about the Reins, Emulgents to the Reins; the *Spermaticæ* to the Teſticles, the *Lumbares Inferiores* to the Muſcles of the Loins, the *Meſenterica Inferior*, which with the Superior is diſtributed through all the *Meſenterium*, and which accompanies all the Branches of the *Venæ Meſenteriacæ*. When the *Aorta* is come to the *Os Sacrum*, it divides into two great Branches; and from the Angle they make, ſprings out a ſmall Artery called the *Sacra*, becauſe it is ſpread upon the *Os Sacrum*. The Iliack Arteries divide again into the external and internal Iliacks.

From the internal Iliack ariſes the *Hypogaſtrica*; it is diſtributed to the Bladder, to the *Rectum*, to the outer and inner Side of the *Matrix*, *Vagina*, *Veſiculæ Seminales*, *Proſtatæ*, and *Penis*, to the *Os Sacrum*, and to all the Parts contained in the *Pelvis*, or Baſon. Then it gives two conſiderable Branches which go out of the lower Belly. The firſt paſſes under the *Pyriformis*, and is diſtributed to the *Muſcles* called *Glutæi*. The ſecond, which is lower than the firſt, gives alſo two Branches pretty big, of which the firſt goes to the *Obturatores*, the ſecond pierces the Cavity of the *Abdomen*, under the *Pyriformis*, and loſes itſelf by ſeveral Branches in the *Glutæus Major*.

As ſoon as the external Iliack leaves the Cavity of the *Abdomen*, it ſends out the *Epigaſtrica*, which runs up the Inſide of the *Muſculus Rectus*; and a little below that, the *Pudenda*, which goes to the Privities. Then it is called *Cruralis*, which ſends out three conſiderable Branches.

The firſt is called *Muſcula*, which gives ſeveral Branches. The firſt paſſes between the Muſcles called *Iliacus* and *Pectineus*, and loſes itſelf in the third Head of the *Triceps*, in the *Semi-membranoſus*, or *Semi-nervoſus*, in the Beginning of the *Biceps*, in the *Quadrigemini*, and in the Cavity of the great *Trochanter*.

The ſecond, third and fourth go to ſeveral Parts of the *Triceps* and *Gracilis Poſterior*.

Then the Trunk of the *Muſcula* goes under the firſt of the *Triceps*, and divides into three Branches more.

The firſt having paſſed the third of the *Triceps*, is loſt in the *Semi-membranoſus*. The ſecond paſſes under the *Femur* to the *Vaſtus Externus*. The third goes a little lower, caſts Branches to the Tendon of the third of the *Triceps*; it loſes itſelf at the End of the *Semi-nervoſus*, and at the End of the great Head of the *Biceps*.

The ſecond conſiderable Branch of the Trunk of the Crural goes to the external Part of the Thigh, paſſes under the *Sartorius*, under the *Gracilis Rectus*; it caſts ſome Branches to the End of the *Iliacus*, to the Beginning of the *Gracilis Rectus*, to the *Vaſtus Externus*, *Cruralis*, *Membranoſus*, and fore Part of the *Glutæus Minor*.

The third riſes almoſt from the ſame Part of the Crural, and loſes itſelf in the Middle of the *Gracilis*, *Rectus*, *Cruralis*, and *Vaſtus Externus*.

The Crural having ſent out theſe three Branches, gives ſeveral Branches to the *Sartorius*, to the *Gracilis Poſterior*, but the greateſt goes to the *Vaſtus Externus*.

As the Crural deſcends, it ſinks the deeper in the hind Part of the Thigh, paſſing through the Tendons of the *Triceps*: Being come to the Ham, the firſt Branch it ſends out is ſpread on the hind Part of the Thigh Bone, and it goes to the little Head of the *Biceps*; then it caſts out ſeveral other Branches, which loſe themſelves in the Fat, and in the Extremities of the Muſcles behind the *Femur*. Under the Ham it ſends out two *Poplitææ*, which go round the Knee, the one in the Inſide, the other in the Outſide. It caſts out, a little lower, ſeveral other Branches, of which ſome go to the Beginning of the *Gemini*, of the *Solæus Plantaris*, and *Poplitæus*; and the reſt ſurround the *Tibia* on all Sides.

Then it divides into two Branches, of which the firſt paſſes through the Membrane, which joins the *Tibia* and *Perone* together; upon which it continues its Way, giving Branches to the *Tibiæus Externus*, and to the *Extenſores Digitorum.*

The ſecond Branch divides into two more, the one external, the other internal.

The external, after it hath given Branches to the *Solæus*, to the *Peronæus Poſterior*, and to the *Flexor Pollicis*, pierces the Membrane between the *Tibia* and *Perone*; riſes upon the external Ancle, to ſpread itſelf upon the upper Part of the Foot.

The internal, as it deſcends, gives Branches to the *Solæus*, to the *Flexores Digitorum*, to the *Tibæus Poſterior*; then it paſſes by the Cavity of the *Perone*, where it divides into two Branches, of which one paſſes under the *Tenar* to the great Toe, the other paſſes between the *Muſculus Brevis* and the *Hypotenar*, and is diſtributed into the other three Toes.

This is the Order and Diſtribution of the principal Arteries in the Body, each of which are ſubdivided into others, and theſe again into others, till at laſt the whole Body is over-ſpread with moſt minute Capillary Arteries; concerning which, there are two Things remarkable. Firſt, That the Branches which go off at any ſmall Diſtance from the Trunk of an Artery, unite their Canals into one Trunk again, whoſe Branches likewiſe communicate with one another, and with others, as before. By this means, when any ſmall Artery is obſtructed, the Blood is brought by the communicating Branches to the Parts below the Obſtruction, which muſt otherwiſe have been deprived of their Nouriſhment. Theſe Inoſculations are apparent every where, but chiefly in the *Uterus*, Meſentery, and Brain. It is the ſame Thing with the *Veins*.

The other Thing is, That the Sum of the Orifices of the Branches of any Artery is greater than the Orifices of the Trunk from which they came; and upon this Conſideration the Velocity of the Blood is mightily diminiſhed as it removes from the Heart. The Proportions the primary Branches bear to one another, and the *Aorta* to the *Cava* and Pulmonary Artery, are as follows;

The *Aorta*	100000
Right Subclavian Artery	20101.9
Left Carotide	10016
Left Axillary	14456.7
Bronchal Artery	434.2
24 Intercoſtals, each 434.2	10420.8
Cæliack	4830.3
Meſenterick	7307.8
Right Emulgent	4639
Left Emulgent	4639
Inferior Meſenterick	3015
5 Lumbals, each 434.2	2605.2
Left Iliack	9739.8
Right Iliack	10535
The Sum of all the Branches	102740.7

The

The Pulmonary Artery	139291.8
The Aſcending *Cava*	92373
The Deſcending *Cava*	92373

SECT. VII.

Of the Veins in general.

THE Veins are only a Continuation of the extreme Capillary Arteries, reflected back again towards the Heart, and uniting their Channels as they approach it, till at laſt they all form three large Veins; the *Cava Deſcendens*, which brings the Blood back from all the Parts above the Heart; the *Cava Aſcendens*, which brings the Blood from all the Parts below the Heart; and the *Porta*, which carries the Blood to the Liver.

The Coats of all the Veins are the ſame with thoſe of the Arteries, only the Muſcular Coat is as thin in all the Veins, as it is in the Capillary Arteries; the Preſſure of the Blood againſt the Sides of the Veins being leſs than that againſt the Sides of the Arteries.

In the Veins there is no Pulſe, becauſe the Blood is thrown into them with a continued Stream, and becauſe it moves from a narrow Channel to a wider.

The Capillary Veins unite with one another, as has been ſaid of the Capillary Arteries.

In all the Veins which are perpendicular to the Horizon, excepting thoſe of the *Uterus* and of the *Porta*, there are ſmall Membranes or Valves; ſometimes there is only one, ſometimes there are two, and ſometimes three placed together, like ſo many half Thimbles ſtuck to the Sides of the Veins, with their Mouths towards the Heart, they are preſſed cloſe to the Sides of the Vein; but if Blood ſhould fall back, it muſt fill the Valves; and they being diſtended, ſtop up the Channel, ſo that no Blood can repaſs them.

SECT. VIII.

Of the Cava Deſcendens, *or* Superior.

FOR the more eaſy deſcribing of the *Veins*, I ſhall begin at their Trunks, and proceed to their Branches contrary to the Motion of the Blood in them. And firſt of the *Cava Deſcendens*, or that in which the Blood returns from all the Parts above the Heart.

The Trunk of the *Cava Deſcendens* joins the Trunk of the *Cava Aſcendens*, and both together open into the Right Auricle of the Heart. On the Inſide of the Vein where the Trunks join, there is a ſmall Protuberance, which hinders the Blood which comes from the upper Parts, from falling upon that from the inferior Parts, but diverts both into the Auricle, where the *Cava Deſcendens* joins the Auricle: It receives the Coronary Vein of the Heart.

As ſoon as it pierces the *Pericardium*, it receives the Αζυγος, or *Vena ſine Pari*; this Vein runs along the right Side of the *Vertebræ*

bræ of the *Thorax*, and is made by the Union of the Veins of the Ribs on each Side. Its ſmall End, at the *Diaphragma*, is divided into two Branches, which communicate with a Vein, ſometimes from the Emulgents, and ſometimes from the *Cava Aſcendens*.

The *Cava Deſcendens* receives next the *Intercoſtalis Superior*, which is diſtributed in the Interſtices of the four firſt Ribs, to which the *Azygos* come not. Remark, That the Branches both of the one and the other run in the *Sinus's* which are on the lower Sides of the Ribs.

Sanmichellius hath obſerved, that the Trunk of the *Cava Deſcendens* receives a Branch called *Pneumonica*; it is this Branch which accompanies the *Arteria Bronchialis* of M. *Ruyſch*.

SECT. IX.

Of the Venæ Subclaviæ, Jugulares, *and their Branches*.

THE Trunk of the *Cava Deſcendens*, as ſoon as it comes to the *Claviculæ*, where it is ſuſtained by the *Thymus*, is divided into two Branches, the one goes to the Right, the other to the Left; they are called *Subclaviæ*; which receive ſeveral other Branches.

The firſt is the *Mammaria*, which comes ſometimes into the *Cava*, before it divides into the *Subclaviæ*; this Vein is diſtributed in the Breaſts, and frequently it goes lower, et, and makes an *Anaſtomoſis* with ſome Branches of the *Epigaſtrica*.

The ſecond is the *Mediaſtina*, which is ordinarily one opening into the Trunk of the *Cava*; it goes to the *Mediaſtinum*, and *Thymus*.

The third is the *Cervicalis*, or *Vertebralis*, which goes up the *Vertebræ* of the Neck, and caſts ſome Branches by the by to the *Medulla Spinalis*.

The fourth is the *Muſcula Inferior*, which comes ſometimes into the Jugulars; it is diſtributed through the inferior Muſcles of the Neck, and the ſuperior of the Breaſt. The Branch that anſwers this is called *Muſcula Poſterior*, becauſe it is diſtributed in the *Muſcles* which are in the hind Part of the Neck.

After that the *Rami Subclavii* are come out of the Cavity of the Breaſt, they are called *Axillares*; they receive the *Scapularis Internus* and *Externus*, which goes to the Muſcles of the *Scapula*, and to the Glands in the Arm-pits: Then they are divided into two Branches; the ſuperior is called *Cephalica*, and the inferior *Baſilica*.

Into the *Baſilica* open the *Thoracica Superior*, which goes to the Dugs and Muſcles of the Breaſt. The *Thoracica Inferior*, which ſpreads itſelf upon the Side of the Breaſt, by ſeveral Branches which communicate by *Anaſtomoſis*, with the Branches of the *Azygos*, under the Muſcles of the Breaſt.

The *Subclavii* receive alſo the *Jugulares Externi* and *Interni*, which go to the Head.

The *Jugulares Externi* aſcend towards the

Ears, where they divide into two Branches, the one internal, the other external. The internal goes to the Muſcles of the Mouth and of the *Os Hyoides.* The external lying upon the *Parotides*, divide into two Branches, of which one is ſpread through all the Face; and the Branches of the one Side unite with thoſe on the other Side, and form the *Vena Frontis*: The other Branch goes to the Temples and hind Head.

The *Jugulares Interni* aſcend to the Baſis of the *Cranium*, where they are divided into two Branches, of which the greateſt open into the *Sinus Laterales* of the *Dura Mater*, by the Holes through which the eighth Pair of Nerves come out; the leaſt goes to the *Pia Mater*, by the Hole which is nigh the *Cella Turcica.*

SECT. X.

Of the Veins of the Arms and Hands.

THE *Baſilica* and *Cephalica* are the two principal Veins of the Arms and Hands.

The *Cephalica* creeps along the Arm between the Skin and the Muſcles; it divides into two Branches.

The external Branch goes down to the Wriſt, where it joins the *Baſilica*, and turns up to the Back of the Hand, where it gives a Branch which makes the *Salvitella* between the Ring Finger, and the little Finger. The Antients uſed to open this Vein in Diſeaſes of the Head, in continued and intermitting Fevers; but the Moderns approve not of this particular Practice. Since the Knowledge of the Circulation of the Blood, there is no Difference whether one be blooded in the *Cephalica*, *Mediana* or *Baſilica*.

The internal Branch of the *Cephalica*, together with a Branch of the *Baſilica*, makes the *Mediana*.

The *Baſilica*, which is the inferior Branch of the *Axillares*, divides into three Branches, under the Tendon of the *Muſculus Pectoralis*.

The firſt Branch accompanies the fourth Branch of Nerves that goes to the Arm.

The ſecond is called *Profundus;* it reaches below the Elbow, where it divides into two Branches: The one external, which goes to the Thumb, the fore Finger, and to the *Muſculi Extenſores Carpi:* The other internal, which goes to the middle Finger, to the Ring Finger, to the little Finger, and to the inner Muſcles of the Hand.

The third Branch is called *Subcutaneus;* towards the inner Condyle of the Arm, it dives into the *Ramus Anterior* and *Poſterior:* The firſt goes under the Muſcles of the *Ulna* to the little Finger, where it joins the Branch of the *Cephalica;* the ſecond, near to the Elbow, ſends out a Branch which goes to the Wriſt; then it unites with the *Cephalica Interior*, and forms the *Mediana*.

The *Mediana*, which is made of the *Cephalica Interior*, and the ſecond Branch of the *Ramus Subcutaneus* of the *Baſilica*, divides into two Branches upon the *Radius;*

the one external, called *Cephalica Pollicis*, which runs between the Thumb and the fore Finger; the other internal, which goes between the Ring Finger and the middle Finger, and ſometimes between this laſt and the fore Finger.

SECT. XI.

Of the Trunk of the Cava Aſcendens, *or* Inferior.

THE Trunk of the *Cava Aſcendens*, between the Heart and the *Diaphragma*, does not ly upon the *Vertebræ*, but runs at a ſmall Diſtance from them. At the *Diaphragma* it receives the *Phrenica* or *Diaphragmatica*. When it has pierced the *Diaphragma*, it receives ſome large Branches from the Liver; then the *Cava Aſcendens* accompanies the great Artery from the Liver to the fourth *Vertebræ* of the Loins, where it divides into two great Branches, called *Iliaci;* but before this Diviſion it receives four Branches from each Side.

The firſt is the *Vena Adipoſa* or *Renalis*, which is ſpread on the Coat and Fat that covers the Reins.

The ſecond is the *Vena Emulgens*, which goes to the Kidneys, where it divides into ſeveral more Branches.

The third is the *Vena Spermatica*, of which we have already ſpoken.

The fourth is the *Vena Lumbaris*, which is not always one, but often two or three on each Side, which they divide into *Superior* and *Inferior;* they are beſtowed on the Muſcles of the Loins, and on the *Peritonæum.* They ſometimes call the laſt Branch of the *Lumbaris, Muſcula Superior.*

There are ſome Anatomiſts that have obſerved, that there is a Branch of the *Lumbaris* that enters the Cavity of the *Vertebræ,* and which aſcends to the Brain; which gave them occaſion to think, againſt all Probability, that the Seed deſcended by that Vein from the Brain.

A little below the Emulgents, the great Artery goes above the *Cava;* and then the *Cava* divides into two Branches called *Iliaci,* becauſe they paſs above the *Ilia* to go to the Thighs. Near this Diviſion they receive one or two Branches called *Venæ Sacræ,* they go to the *Medulla* of the *Os Sacrum.*

Then the *Vena Iliaca* divides into two Branches, the one internal, the other external. The internal receives two Branches, the *Muſcula Media,* which is ſpread through the Muſcles of the Thigh; the *Hypogaſtrica,* which is ſometimes double, and ſpread about the *Sphincter* of the *Anus;* therefore it is called their *Hæmorrhoidalis Externa.* The *Hypogaſtrica* is ſpread alſo upon the Body of the Bladder, upon the *Matrix* and its Neck.

The external Branch of the *Iliaca* receives three Branches, two before it goes out of the *Peritonæum,* and the third after it goes out of it.

The firſt is the *Vena Epigaſtrica,* which comes rarely into the *Cruralis;* it goes to the *Peritonæum,* aſcends to the *Muſculi Recti,* where it renoounters the *Mammariæ*, with which it communicates by *Anaſtomoſis.*

The ſecond is the *Vena Pudenda;* it is ſpread upon the Parts of Generation.

The third is the *Muſcula Inferior;* it goes towards the Articulation of the *Femur*, and is diſtributed to the Muſcles of this Part.

The *Iliaca Exterior*, after it hath received all theſe Branches, takes the Name *Cruralis*, and then receives ſix Branches more.

The firſt is the *Vena Saphæna*, which goes down under the Skin along the Inſide of the Thigh and Leg, accompanied with a Nerve which loſes itſelf at the inner Ancle. The *Saphæna* turns towards the upper Part of the Foot, where it gives ſeveral Branches, of which ſome go to the great Toe.

The ſecond is the *Iſchias Minor;* this Vein is little; it is ſpent on the Muſcles and Skin which are about the upper Joint of the *Femur*.

The third is the *Muſcula Externa*, becauſe it goes to the external Muſcles of the Thigh. On the other Side of the *Cruralis* juſt oppoſite to the Beginning of this Vein, there goes out another called *Muſcula Interna*, which goes to the internal Muſcles of the Thigh.

The fourth is the *Poplitæa*, made of two different Branches united together; it goes ſtraight down by the Ham to the Heel; it lies pretty deep, upon which Account it can hardly be opened. The Branches which appear in this Place are not of this Vein.

The fifth is the *Suralis*, which is pretty big, and which divides into two Branches;

the

the one external, which is leaſt; the other internal, which is biggeſt. Each of theſe Branches divide again into two more; the one external, the other internal.

The *Suralis* diſtributes its Branches upon the Fat of the Leg, and makes, with the Branches of the *Poplitæa*, all thoſe *Plexus* of Veins which are conſpicuous on the upper Part of the Foot.

The ſixth and laſt Branch of the *Cruralis* is the *Iſchias Major*, which goes alſo to the Muſcles and Fat of the Leg, and is divided afterwards into ſeveral Branches, which are diſtributed to the Toes.

SECT. XII.

Of the Vena Porta.

THUS we have deſcribed the Veins which come from all the Parts of the Body, except the Stomach, Spleen, *Pancreas*, *Omentum*, and Inteſtines, from which Part the Blood is carried by the Branches of the *Porta* to the Liver, to be returned by the Branches of the *Cava* in the Liver, after that the Bile has been ſeparated from it, as has been ſaid in the *Section* of the *Liver*.

The *Vena Porta* was ſo called by the Antients, becauſe they thought that it brought the Chyle by its Meſeraick Branches from the Inteſtines to the Liver, through whoſe Subſtance it is ſpread. As it ariſes out of the Liver, it receives two ſmall Veins from the *Veſica Fellis* called *Cyſticæ Gemellæ*, one from the Stomach called *Gaſtrica Dextra;* then advancing a little to the left, its Trunk divides into two Branches, of which the leaſt, called *Ramus Splenicus,* goes to the left *Hypochondrium:* And the greateſt, called *Meſentericus,* goes to the right. The *Ramus Splenicus,* ſo called, becauſe it carries the Blood from the Spleen, receives two Branches called *Gaſtrica Minor, & Major,* which are ſpread through all the Stomach. A Branch of the *Gaſtrica Major* makes the *Coronariæ Stomachicæ* at the upper Orifices of the Stomach. It receives three Branches more, two from the *Omentum* and *Colon,* and the third from the *Pancreas.*

Then the *Splenicus* divides into two Branches; the one ſuperior, the other inferior.

The Superior receives the *Vas Breve,* and ſome other Branches which come from the Spleen.

The inferior receives two Branches, *viz.* the *Epiplois Siniſtra* which is ſpread through the back Part of the *Omentum,* and that Part of the *Colon* which is under the *Stomach.* The other Branch is the *Gaſtro-Epiplois Siniſtra,* which is alſo ſpread upon the *Omentum* and upon the Stomach; it makes ſometimes the *Vena Hæmorrhoidalis Interna.* The reſt of this inferior Branch comes from the Subſtance of the Spleen.

The right Branch of the *Porta,* called *Vena Meſenterica,* before it divides, receives the *Gaſtro-Epiplois Dextra,* which is ſpread in the *Omentum* and lower Part of the Stomach; as alſo the *Inteſtinalis,* which comes from the *Duodenum,* and the *Jejunum;* it receives ſome Branches from the *Omentum* and *Pancreas.*

Then the *Deſenterica* divides into three great Branches which run betwixt the Duplicature of the *Meſenterium.* Two of them come from the right Side, which divide into fourteen Branches; and theſe are again divided into an Infinity of others leſs, which are called *Meſeraicæ;* they creep upon the *Jejunum, Ilium, Cæcum,* and Part of the *Colon.*

The third and laſt Branch of the *Vena Meſenterica* is ſpread through the Middle of the *Meſenterium,* to that Part of the *Colon* which is on the left Side, to the *Rectum,* down to the *Anus,* where it forms the *Hæmorrhoidales Internæ.*

FINIS.